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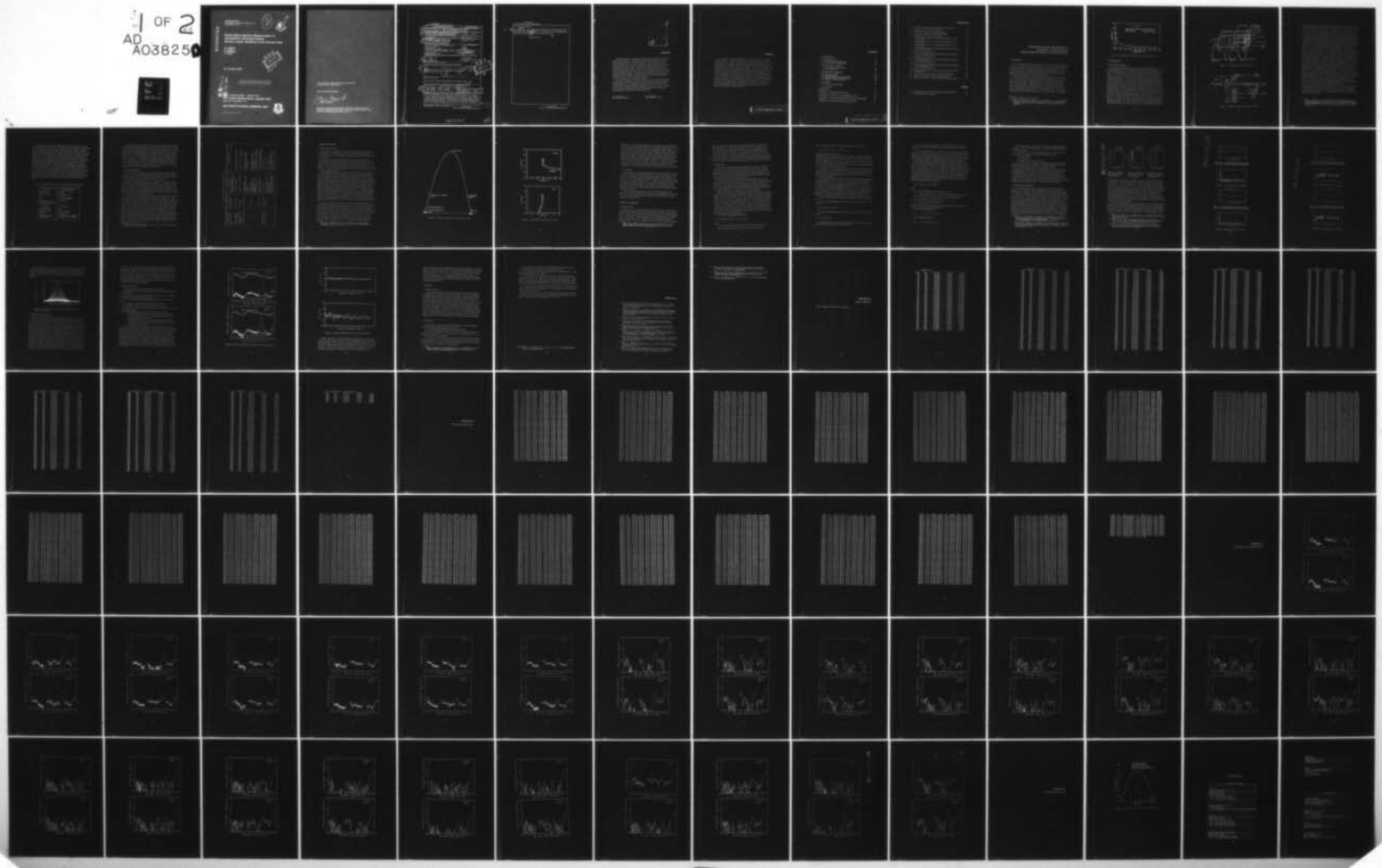

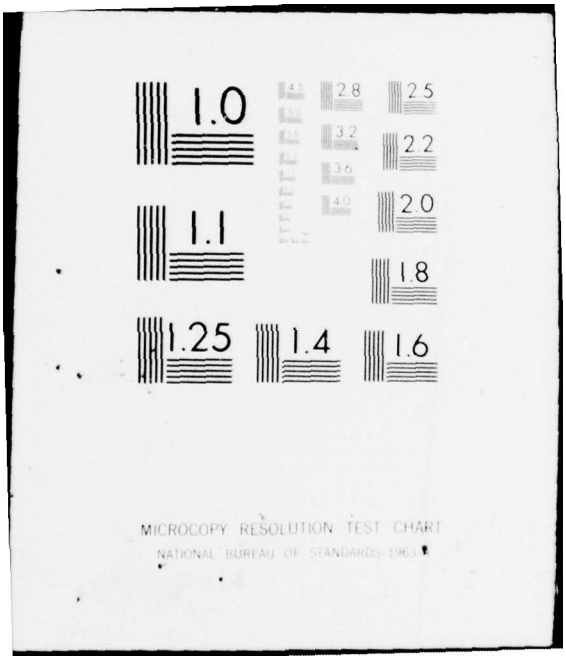
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Rocket-Borne Spectral Measurement of Atmospheric Infrared Emission During a Quiet Condition in the Auroral Zone

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27 October 1976

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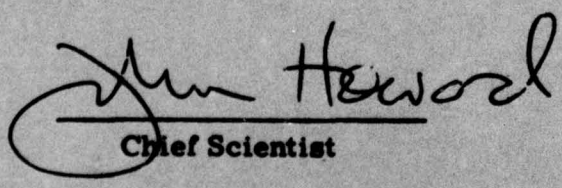

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A Nike-Javelin rocket (NJ-74-1) was launched at Poker Flat, Alaska, on 11 Apr 74 at 0801 hours UT during a non-auroral condition. A near-zenith spectral radiance profile was obtained from 54 km to an apogee of 118 km on ascent, and from 118 km down to about 85.6 km on descent, using a circular variable filter spectrometer. About 464 spectral scans were obtained during flight, covering the range from 1.7 to 5.4 μm at a resolution of about 4 percent. The dominant emission feature was at 4.3 μm, which is attributed to → next page

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20. Abstract (Continued)

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the CO_2 (ν_3) fundamental. The upward viewed spectral radiance appeared to range from about 215 MR/μm at 54 km to less than the noise equivalent spectral radiance of 3 MR/μm at 118 km. In this report are given the first quiet condition (no aurora) rocket data in the auroral zone.

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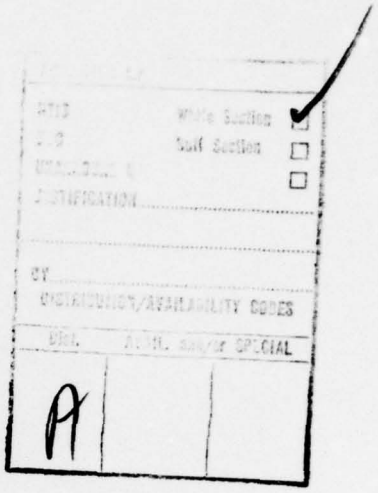

Foreword

A High Altitude Effects Simulation (HAES) Program is being conducted by the Defense Nuclear Agency. Under HAES, several related but distinct measurement programs have been or will be conducted to provide information for the development and test of predictive computer codes that will be used to assess and evaluate the operation of critical DOD radar and optical infrared systems in nuclear disturbed environments. The Air Force Geophysics Laboratory's work under the HAES program will be reported under the HAES series as AFGL Environmental Research Papers. The reports will also identify the measurement program (for example, ICECAP, EXCEDE, SPIRE, and so forth) so that related reports and results can be correlated and utilized.

This report presents the data for the NJ74-1 Circular Variable Filter (CVF) spectrometer and includes a description of the processes involved in completing the data reduction. A presentation of the CO_2 data will be given that includes altitude profiles and peak wavelength positions as a function of altitude. Included are actual scans of spectrometer data with indications of spectral resolution, dynamic range, and minimum detectable signal levels.

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HAES Project Scientist

J.C. ULWICK
HAES Technical Director

Preface

The authors wish to express appreciation to the many scientists, engineers, program directors, computer programmers, and clerical personnel that were responsible for the design and calibration of the rocket instruments, execution of the field program, reduction of the data and preparation of this report. Those who made special contributions were W. F. M. Grieder, C. L. Wyatt, K. D. Baker. In particular we wish to commend the efforts of Messrs. Robert E. McInerney, John Kotelley, Edward Robinson of the AFGL Computations Center (SUYA) for the design and management of data processing system used in rendering the data and Messrs. Dennis Dolorey, Niel Grossbard, and Miss Carol Foley of the Space Data Analysis Laboratory, Boston College, Boston, Mass., for developing and implementing data analysis routines used in the data processing system. In addition appreciation is extended to Mrs. Visniewsky of AFGL and Mrs. Gloria Foss of SRL for their superior effort in the technical typing of the manuscript and to SUSRP for editing and compiling the report.

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Rocket-Borne Spectral Measurement of Atmospheric Infrared Emission During a Quiet Condition in the Auroral Zone

I. INTRODUCTION

At wavelengths beyond about 2.5 μm balloon- or rocket-borne instruments are necessary for studying infrared emission features in the aurora because of thermal radiation from the lower atmosphere and strong absorption in a number of important spectral regions. Attempts have been hampered in extending to any great degree auroral spectroscopic measurements into the near infrared by the lack of high-sensitivity detectors for the region beyond about 1 μm.

During quiet conditions at auroral altitudes the dominant species are N_2, O_2, and O. Infrared active species exist in the spectrum beyond 2 μm that are rich in vibration-rotation bands. Significant enhancement in the intensity of ν_3 fundamental of CO_2 at 4.26 μm is expected because of strong collisional coupling of $N_2(v = 1)$ with $CO_2(00^o1)$.[1] The significance of this report is that this enhancement is obviously not present because of the quiet auroral condition but a definite knee can be observed at approximately 86 km as shown in Figure 1. These data concern quiet auroral conditions essential to correct modeling of the atmosphere.

(Received for publication 26 October 1976)

1. Baker, K. D., Baker, D. J., Ulwick, J. C., and Stair, A. T., Jr., Rocketborne Measurements of Infrared Enhancements Associated with a Bright Auroral Breakup, Rocket No. A10.205-2, HAES Rpt No. 50(ICECAP Series) to be published.

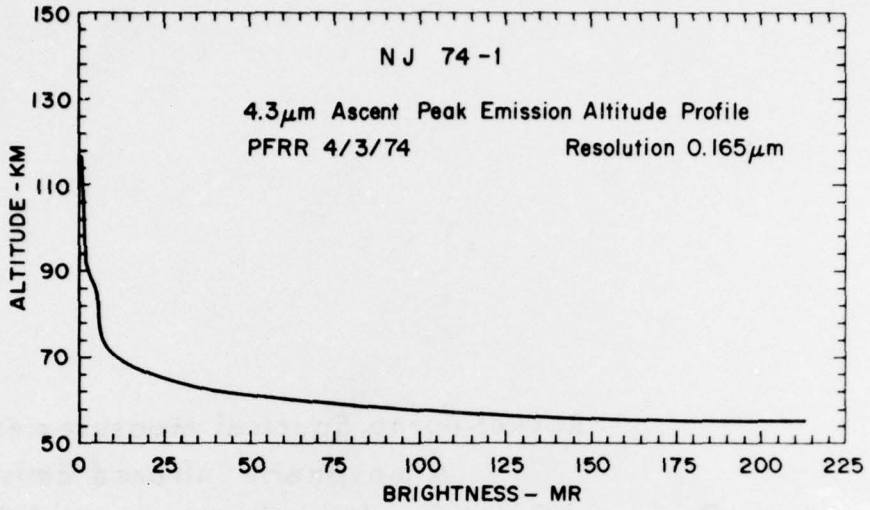

Figure 1. Altitude Emission Profile for the CO_2 Peak During Ascent

2. INSTRUMENTATION

2.1 Rocket Payload Configuration

The primary flight instrument on this rocket was a Short Wave Infrared Radiation (SWIR) Spectrometer designed and built by the Electro-Dynamics Laboratory of Utah State University. A cutaway view of this instrument is shown in Figure 2. The SWIR spectrometer about which this report is written consists of three distinct parts, that is, electronics, cryogen, and optical compartments. The cryogen capacity was 1/2 liter which provided a 3-hr operating time before refilling was necessary. A block diagram of the SWIR spectrometer system is shown in Figure 3. The optical axis passes through a window which provides a seal between the radiation source environment and the optical cold compartment. This is necessary to allow backfilling the cold optical compartment to a pressure of approximately 1/3 atmosphere with dry nitrogen gas which accelerates the cooling process of the circular variable filter. The circular variable filter must be cooled to a temperature below 130°K in order for the cold mask on the filter to provide a zero signal (minimum noise equivalent radiance) reference. The window has a 1/2-in. aperture and together with the positive meniscus lens provides an effective f/1 system. The f number being defined as the focal length divided by the entrance aperture size. The optical axis after passing through the lens goes through the filter where the energy is resolved into its wavelength components as

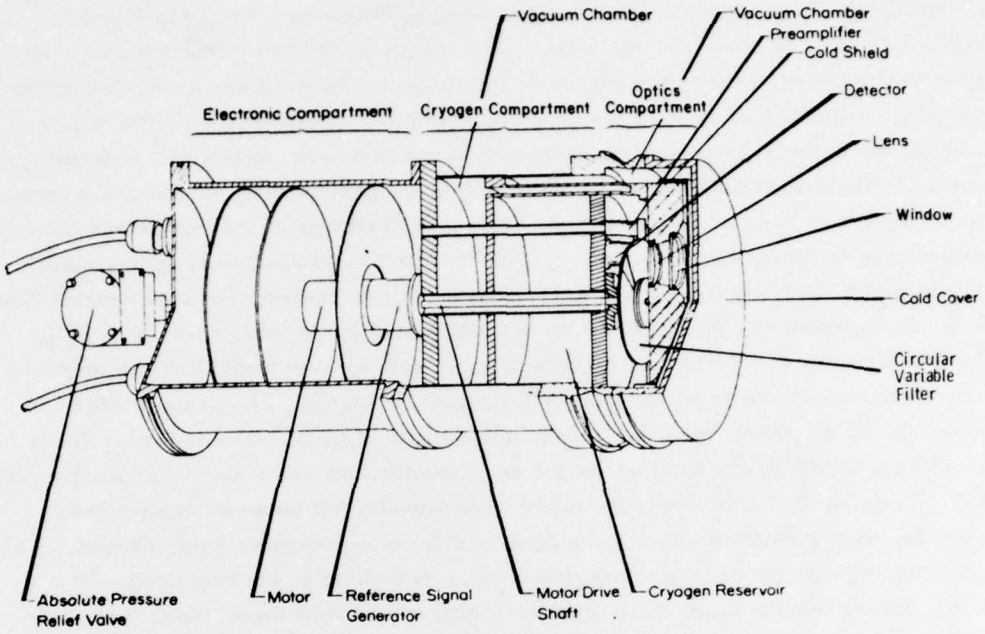

Figure 2. Cutaway View of the CVF Spectrometer

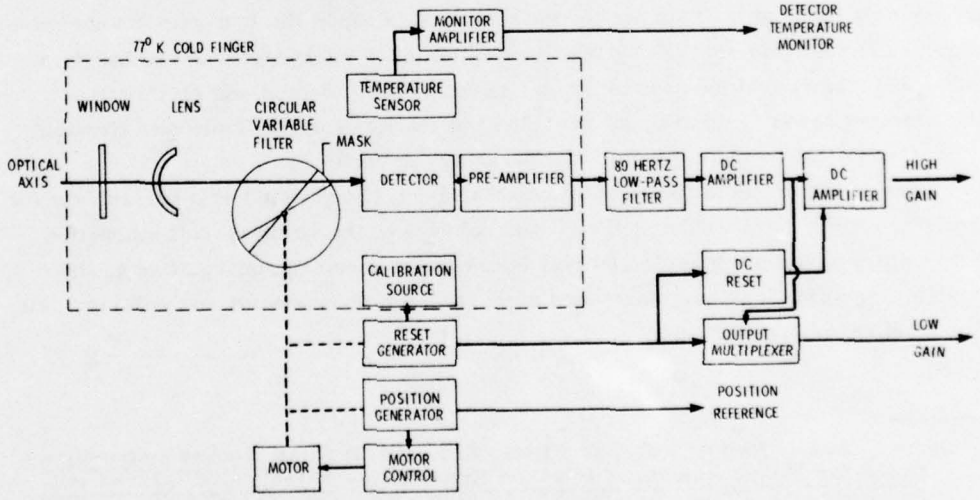

Figure 3. Simplified CVF Spectrometer Block Diagram

a function of filter wheel position. The filter wheel has two metal masks covering the 0° and 180° joints of the filter. The larger of the two metal masks is used as a zero reference for resetting the dc amplifiers, that is, compensating for any dc offset voltages that introduce errors in absolute radiance levels. The motor rotates the filter at a controlled speed of 2 revolutions per second and generates a set of pulses known as the position reference for determining wavelength position as a function of angular displacement. The optical energy is focused on the Indium Antiminide detector where this energy is converted to an electrical analog signal. The signal is then processed by the detector-preamp-feedback resistor combination to a low impedance signal prior to being conditioned by the 80-Hz low-pass filter. This filter removes the higher frequency noise and permits sufficient electrical bandwidth to observe expected radiation intensity changes. The preamplifier, detector, filter wheel, lens and window all operate at 77°K. The low-pass filter supplies a conditioned signal to the 1st dc amplifier that has a gain of approximately 100. The output of this amplifier is not used directly but becomes multiplexed with the reset generator prior to being available as a low-gain output channel. This multiplexing was necessary to provide a reference pulse at the beginning of the scan, during the blanking of the detector signal by the cold mask, so that the beginning of a filter scan can be determined. The filter wavelength location as a function of angular position can now be calibrated as a percent of a full scan using this reference pulse. The signal from the 1st dc amplifier now goes to the 2nd dc amplifier where an additional gain of 10 is realized. The output of the 2nd dc amplifier is directly available as the high-gain channel. In addition to the two signal channels, a position reference channel is available; however, this channel was not used during the flight. This procedure was used because the low-gain channel contained sufficient information for the determination of wavelength needed for data reduction. Temperature monitors were used for the detector and electronics. The cryogen dewar compartment provides the storage for the liquid nitrogen that keeps the optical compartment at its operating temperature.[2]

Support instrumentation on this rocket (NJ-74-1) consisted of a horizon sensor for determining the position of the rocket relative to the earth, a roll magnetometer which gives pitch angle and roll information of the rocket relative to the earth's magnetic field, and an S-band airborne telemetry system for relaying data to ground recording stations.

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2. Jensen, L.L., Kemp, J.C., and Bell, R.J. (1972) Small Rocket Instrumentation for Measurements of Infrared Emissions – Astrobee D30.205-3 and Astrobee D30.205-4, AFCRL-TR-72-0691, Scientific Report No. 3, AFCRL Contract F19628-70-C-0302, Center for Research in Aeronomy, Utah State University.

The SWIR spectrometer was originally designed to fit an Astrobee D rocket with a shell diameter of 6 inches. The instrument is only 14 inches in length which allowed for a compact payload design. The output of the instrument consists of two linear gain channels with 0- to 5-V outputs and gains of approximately 100 and 1000 for the low-gain and high-gain channels, respectively. The low-gain channel voltage of 0 to 5 V represents a spectral radiance range from 3 MR/μm (mega-rayleighs per micrometer) (Noise Equivalent Spectral Radiance) to 110 MR/μm (Saturation Spectral Radiance), respectively, at 4.3 μm. In order to calibrate the relative position of radiant response to the spectral wavelength of the filter, a technique was used whereby a starting pulse was multiplexed at the beginning of the low-gain channel scan. This occurred during the reference mask where no data exists so that all applicable wavelengths can be referenced to this pulse as a percent of full scan. The spectrometer's optical axis was aligned with the rocket axis to provide a vertical look direction. Table 1 summarizes the instrument characteristics. The minimum detectable signal was determined by using a noise voltage of one half the peak-to-peak value which in this instrument was set at 0.5 V.

Table 1. Characteristics of the NJ-74-1 CVF Spectrometer NS-1B-6B

Parameter	High-Gain Channel
Offset Error	+0.023 V
Background Noise	1 V peak to peak or 0.2 V rms
FOV	$\theta = 3.517^{\circ}$ half angle or $\Omega = 0.0118$ sr
Optical Resolution	4 percent
Wavelength Coverage	
Short Half	1.6 to 2.8 μm
Long Half	2.8 to 5.5 μm
Instrument Weight	6 kg
Detector Type	Indium antimonide
Cryogen	Liquid nitrogen
Minimum Detectable Signal Range	1.5 MR/μm at 2.7 μm (Min) 34 MR/μm at 3.2 μm (Max)

The launch vehicle was a Nike-Javelin two-stage rocket which was launched on 11 April 1974 at 101:08:00:59.985 UT and reached an apogee of 118 km. The launch site was Poker Flats Research Range operated by the University of Alaska and situated approximately 30 miles N.E. of Fairbanks, Alaska. The auroral condition was quiet during the entire rocket flight. The first stage or booster engine was 16.5 in. in diameter, the second stage was 9 in. in diameter, and the payload section was 6 in. in diameter. The payload weight was 280 lb with an overall length of 80 in. The time for the total flight was approximately 330 sec. The spectrometer's optical axis was aligned with the rocket axis to provide a vertical looking direction. The vehicle aspect shows a relatively smooth flight with no major fluctuations in data due to rocket behavior.

2.2 Ground-Based Instrumentation

The scientific ground support stations and equipment are listed in Table 2. A review of the Ft. Yukon magnetometer data and the Ft. Yukon and Ester Dome all-sky camera and meridian scanning photometer data for UT April 11, 1974, associated with the launch of PF-NJ-74-1 at 0800 UT follows:

The early evening magnetic activity was very quiet. However, some 50γ to 100γ wiggles in ΔH took place between 0400 and 0700 UT. The activity actually decreased between 0700 and 0800 UT with smaller amplitude (25γ) wiggles. No obvious bay activity to the east occurred prior to the launch of PF-NJ-74-1 at 0800 UT. At 0830 UT the ΔH trace began a slow decrease which reached -150γ by 1000 UT, followed by a small -350γ negative bay at 1020 UT. The major negative bay (-950γ) of the evening occurred at 1315 UT.

Associated with this night's magnetic activity, the all-sky camera at Ft. Yukon shows the formation of an arc at 50° north zenith angle around 0745 UT. The 5577 A photometer data gives an intensity around 4 kR. At 0751 UT the intensity increases to ~10 kR and by 0755 UT there is obvious zenith activity, though <5 kR. This extends to perhaps 60° south of the Ft. Yukon zenith. A double peak at 60° and 50° north of the zenith forms around 0759 UT. From College the southern edge of the precipitation appears to lie between 10° and 20° north of the College zenith. Intensity there is around 1 kR which may be partially due to horizon-scattered twilight. Conditions remained much the same with the southern edge of activity moving slowly equatorward, reaching the geographic zenith at College by 0858 UT. At 0901 UT, a 20 kR arc formed at the magnetic zenith of Ft. Yukon. The precipitation extended to perhaps 20°S of the College zenith by 0910 UT, when both Ft. Yukon and Ester Dome systems were shut down. The weather at Ft. Yukon was partially overcast.[3]

3. Romick, G.J. (1976) Geophysical Institute, University of Alaska, Fairbanks, Alaska, private communication.

Table 2. Scientific Ground Support Stations

Responsibility	Location	Instrument	Measurement
AFGL Mobilab	Poker Flat	Pointing Photometer, Visual Observation Station	
Office of Telecommunication	Poker Flat	Ionospheric Sounder	Partial Reflection Experiment
Stanford Research Institute	Chatanika	Incoherent Scatter Radar	Electron Density Temperature
University of Alaska	Ester Dome	All Sky Camera Meridian Scanning Photometer TV System	Auroral Form, Location Auroral Intensity, Spatial Distribution
	Fort Yukon	All Sky Camera Meridian Scanning Photometer Magnetometer (3 axis) Riometer (30 MHz)	Auroral Form, Location Auroral Intensity, Spatial Distribution Magnetic Field Fluctuations Auroral Radio Wave Absorption
	Poker Flat	Magnetometer (3 axis) Riometer (30 MHz)	Magnetic Field Fluctuations Auroral Radio Wave Fluctuations
Navy Research Lab	40 Mile Elliot	VLF Sounder	VLF Propagation
Utah State University	Poker Flat	LN_2 Cooled Field Widened Interferometer IR Radiometer Spatial Scanning Photometer Filter Wheel Photometer Tilting Filter Photometer	IR Auroral Spectra OH and O_2 Emission Auroral Intensity and Pos. Auroral Intensity - 5 Colors Auroral Intensity - 5 Colors

3. ROCKET FLIGHT SUMMARY

3.1 Rocket Flight Characteristics

The payload was launched by a two-stage spin-stabilized Nike Javelin solid-propellant rocket. The ballistic wind velocity was 29.98 fps at an azimuth of 72.3° true north from Poker Flat Research Range, Alaska with a surface temperature of -16°F.

A scenario of the rocket flight is illustrated in Figure 4. The rocket was launched at an elevation angle of about 84° or 6° from the vertical (zenith angle). Approximately 3 sec after liftoff the first stage motor burned out and was released. The second stage motor burned out at approximately 23 sec and was not released. At this time the rocket attained a spin rate of about 6 rps from the action of the second stage rocket fins.

Above approximately 70 km, with a finned rocket vehicle, the atmospheric drag is small and the vehicle is essentially in free ballistic flight. In addition to the rocket spin (roll) the vehicle exhibited a coning (precession) motion with a period considerably longer than the spin period, typically 15 to 25 sec. For this flight the axis of precession was approximately 156 deg at 58 km and approximately 152 deg at 103 km obtained from the aspect data plotted for ascent and descent in Figure 5. The axis of precession is found by averaging the instantaneous position angle (γ) of the rocket as referenced to the local earth's magnetic field vector. The pitch angle (α) plotted in Figure 5 is defined as $180^{\circ} - \gamma$. The pitch angle α is the angle measured between the rocket axis and the tail of the local magnetic field vector. At approximately 54 km the payload tip was ejected permitting the spectrometer to view the incident infrared radiation. The ejection of the tip usually aggravates the coning motion which continued, having a half angle of approximately 1.5 deg, through apogee and for a time on re-entry while the vehicle decended tail first.

Finally, around 70 km, air drag became effective and the vehicle tipped over and oscillated for a time, then re-entered nose first. Rocket flight characteristics, particularly rocket aspect during measurements, are important in interpreting spectrometer infrared measurements. The reason for this is that obliquely viewed emission regions of space produce increased signals when compared with emitting regions viewed vertically. This phenomenon is commonly referred to as the Van Rhijn effect.[4] Corrections for obliquely measured emissions depend on a number of factors including the viewing angle relative to the vehicle, extinction, instrument field of view, and so forth. In considering the magnetometer data

4. Grieder, W. F. and Whelan, L. A. (1976) Geometric Aspects of Rocket Photometry, AFGL-TR-76-0046, HAES Report No. 41, Space Science Laboratory, Utah State University.

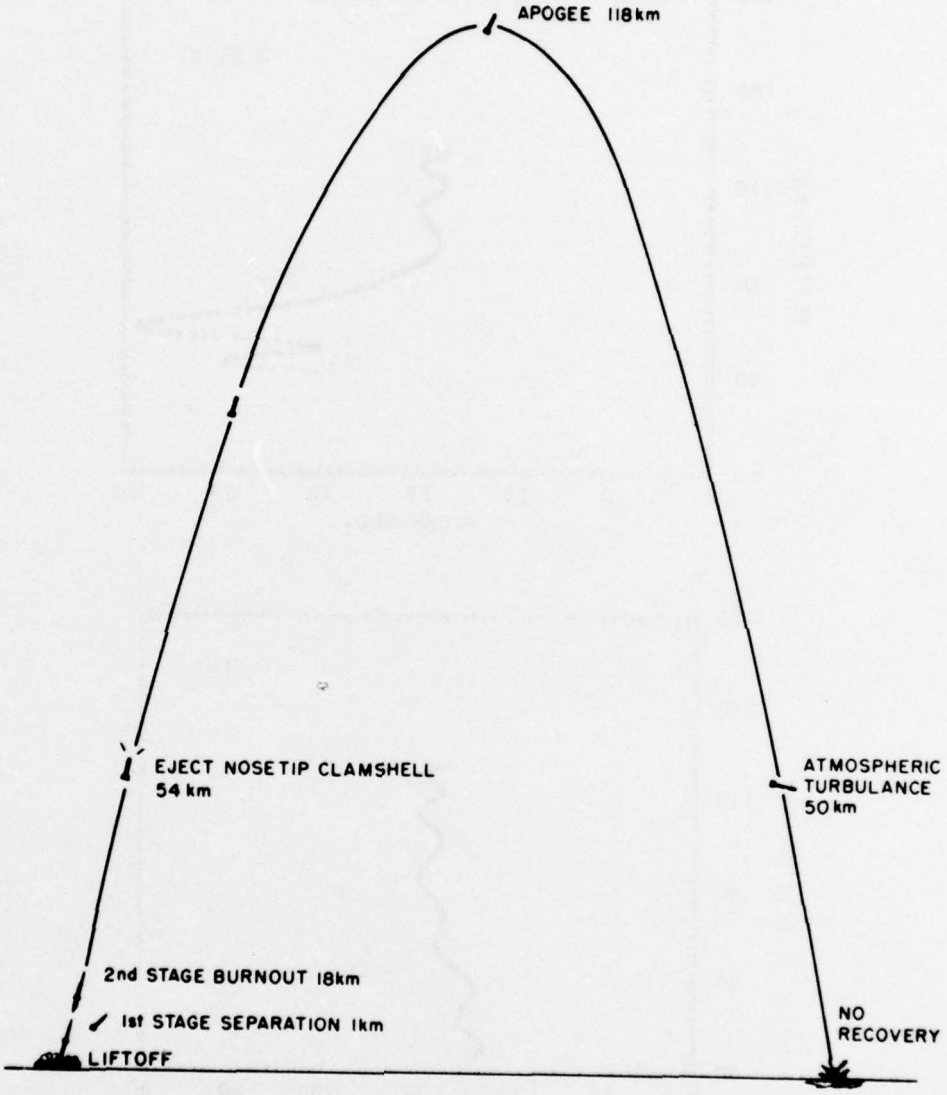
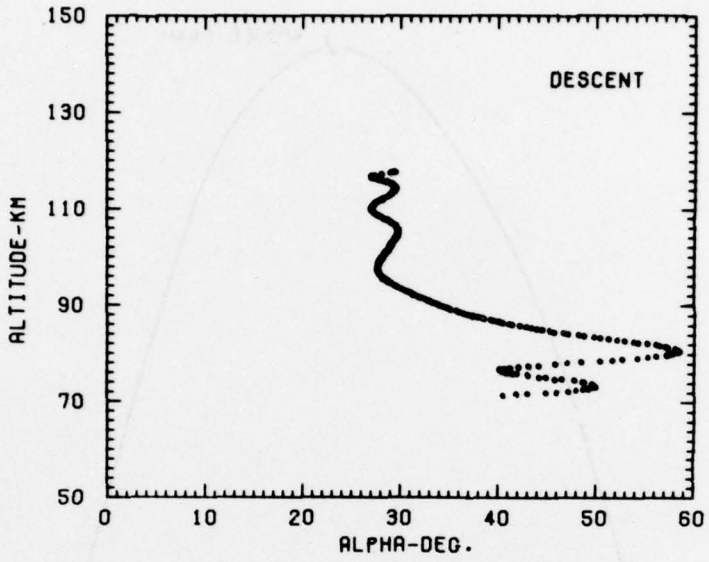


Figure 4. Scenario of a Typical Nike-Javelin Rocket Flight



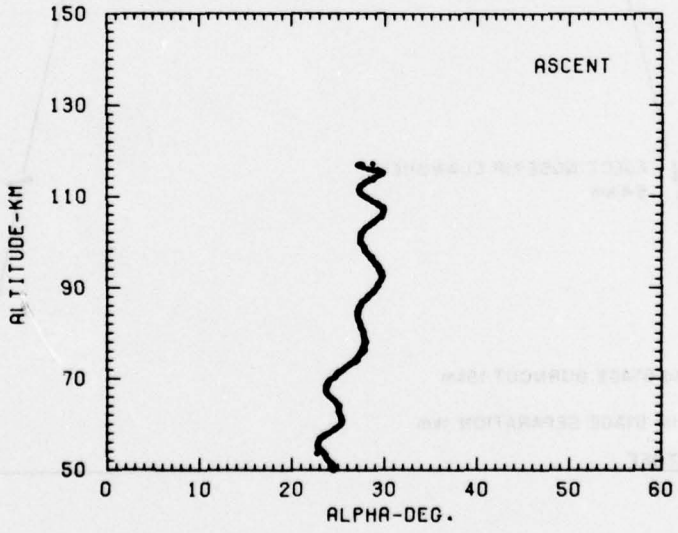


Figure 5. Aspect Plots for Both Ascent and Descent

presented, it is important to understand that the pitch angle as computed represents a cone about the magnetic field vector on which the rocket axis can lie. Any position on this cone will produce the same magnetometer output voltage. For this reason it is essential to introduce additional evidence and/or assumptions to deduce the rocket position on the locus cone.[5] Because this rocket was well behaved, for example, maintained a coning angle less than 3 degrees and a pointing direction no greater than 28.5 degrees, the Van Rhijn correction would not improve the accuracy of the data analysis significantly. However, horizon sensor data is available to make this correction if necessary. No apparent Van Rhijn modulation occurred in the prominent feature of CO_2 since this emission is optically thick. This precludes the use of this data to correct for rocket position.

3.2 Launch Summary

Measurements were made during the time from tip ejection (54 km) to vehicle tip over (~70 km) when the instrument views the earth. The spectrometer measurements are continually modulated throughout the flight by the coning motion; however, in this rocket flight the modulation of data due to coning was very small, for example, less than 2.5 MR at 4.3 μm. The spectrometer must look at a fixed position in space during the period of time that the filter makes one complete revolution for maximum resolution to be realized. This condition can only be approached in real rocket measurements and must always be considered to determine its effect on data.

Other rockets participating as part of the ICECAP 1974 program were A30.413-1 Astrobee D launched 11 April 1974 measuring electron and ion densities; A10.312-3 Paiute Tomahawk launched 18 April 1974 measuring electric fields, ionizations, and particle flux.

4. ROCKET DATA PROCESSING

4.1 Digitization of Data

The data from the rocket flight were transmitted to the ground support receiving and recording equipment by a composite telemetry FM signal. This signal was direct recorded at 60 ips along with a reference frequency to provide for tape speed control. The data tape was discriminated into separate subcarrier analog output voltages and digitized at a rate of 2000 points/sec, correlated with time after launch, and coded in a format compatible with the AFGL CDC 6600 digital computer.

5. Grieder, W.F., Baker, K.D., Stair, A.T., Jr., and Ulwick, J.C. (1976) Rocket Measurement of OH Emission Profiles in the 1.56 and 1.99 μm Bands, AFCRL-TR-76-0057, HAES Report No. 38.

This computer was used for all data processing and plotting. The analog tape data were digitized on a tape deck whose drive motor was synchronized to the reference frequency on one of the TM tape channels. This precluded errors in time due to nonuniform tape speeds. The analog tape data were digitized from 5 sec before launch (T-5 sec) to 305 sec after launch (T + 305 sec). This period of time was selected to cover the entire useful rocket flight data and also 10 scans before motor ignition. The data between T-5 sec and T+30 sec were used to verify that no malfunction of the instrument occurred due to motor impulse or vibration.

4.2 Data Processing

The purpose of the data processing procedures is to establish a relatively consistent method to evaluate rocket data that will be useful to the community. The procedures established for this rocket and for future CVF spectrometers is explained as follows: due to the complexity of the CVF spectrometer data, many factors must be considered when observing an anomaly in the data output so that misleading information can be analyzed correctly.

The CVF spectrometer has a rotating filter with blocking masks over the connecting joints of the two filter halves. One of these masks is used in a dc-reset scheme on the two gain channels. Any radiant energy reaching the detector by scattering, or noise spikes occurring during the reset period, will introduce an error. The background level must be determined prior to data processing so that an absolute calibration can be used to determine signal intensities.

Data scans that do not meet acceptance criteria are not used as part of the data processing. Acceptance criteria include: (a) minimum noise spikes on signal channels, (b) low offset voltages, (c) low drift, (d) absence of internal calibration signal. Scans that meet the acceptance criteria prior to cap removal are used to determine a true background by coadding these scans. The first useful scan after booster motor burnout, designated as Scan No. 1, starts at 30 sec after launch and the final scan number 558 occurs at 305 sec after launch. Spectral position is determined by recognizing the fraction of a full scan that can be determined by a reference pulse at the beginning of each scan at which the spectral feature occurs. This fraction of a full scan at which the spectral line occurs is related to the spectral position by the following equations:

For the short-wavelength half of the filter:

$$\lambda_n = 2.7485\, P_n + 1.4958 \quad , \quad 0 \leq P_n \leq 0.48 \quad ,$$

where

λ_n is the wavelength in micrometers (μm) for the nth point in the scan,

P_n is the fraction of a full scan for the nth point being considered.

The corresponding relation for the long wavelength half of the filter is:

$$\lambda_n = 5.6202\ P_n - 0.009 \quad , \quad 0.48 < P_n \leq 1 \quad ,$$

where λ_n and P_n are defined above.

The beginning of each scan is determined by a start-pulse which is multiplexed with the low-gain channel on IRIG 16. The start of each scan begins at the time when the leading edge of the start pulse reaches 1 V ± 0.5 V. The end of one scan marks the beginning of the next. The total number of digitized points occurring in one scan is used to determine spectral position. Errors in determining spectral position occur due to the following reasons:

(a) A delay in rise time of the beginning of a scan pulse is due to the telemetry IRIG channel filters. A typical delay time would be 1.5 msec and a typical rise time would be 0.5 msec giving a total of 2 msec delay for IRIG channel 14 with a 330 Hz low-pass constant-amplitude filter. However, this delay is common to all signals on a given channel.

(b) The relative error between the low-gain channel and the high-gain channel is approximately 0.6 msec. This error is due to the different bandwidth filters associated with IRIG channel assignments. The discrepancy in wavelength as correlated between the low- and high-gain channels due to a 0.6 msec error could be 0.0072 μm for the long-wavelength half of the filter. This error in spectral position correlated between gain channels is due to the long-wavelength half of the filter scanning 12 μm/sec, for example, this filter scans 3 μm on approximately 250 msec. For the short-wavelength half of the filter this discrepancy could be 0.0036 μm, for example, this filter scans 1.5 μm in approximately 250 msec.

(c) The resolution element of the filter is determined by the following equations:

For the short-wavelength half of the filter, which covers the range of 1.696 to 2.692 μm,

$$\Delta\lambda = 9.23 \times 10^{-3}\lambda + 0.064 \quad .$$

For the long-wavelength half of the filter, which covers the range of 2.995 to 5.45 μm,

$$\Delta\lambda = 0.01\lambda + 0.122 \quad .$$

(d) The deviation from the straight line approximation of the filter's spectral linearity with angular position is typically ±1 percent.

(e) The computer sampling accuracy is approximately ±0.5 msec. This error is due to the fact that the analog-to-digital converter has a resolution of 1 msec.

(f) The wavelength shift due to a point source moving across the field from edge to edge is approximately 0.033 μm. This shift is due to the angle of incident radiation passing through the filter changing as energy moves from edge to edge and thereby causing a different spatial position on the filter to be seen. Moving to a different spatial position on the filter represents a different wavelength.

The absolute brightness in megarayleighs per micrometer (MR/μm) is determined by the following equation after the spectral position has been determined. The zero background discrepancy is less than the noise equivalent spectral radiance of the spectrometer system. The conditions preceding the background measurement at apogee are different from the background measurement with the cover on in that energy had excited the detector shortly before apogee. Because of time constants associated with the detector and circuitry, undesired backgrounds can be observed if signal changes are great enough and the elapsed time between measurements is not sufficient to allow the detector and circuitry to respond in a normal way to the signal being measured.

$$R_{\lambda_n} = GC_{\lambda_n}(V_n - \Delta V_n)^x \quad [\mathrm{MR}/\mu\mathrm{m}] \ ,$$

where

R_{λ_n} = spectral brightness of the nth point in a scan,

C_{λ_n} = inverse responsivity for the nth point in megarayleighs per volt per μm,

V_n = TM volts for the nth point corrected for in-flight calibration,

ΔV_n = reset voltage for the particular scan,

G, x = constants from calibration data.

The two portions of the filter, long- and short-wavelength halves, require separate curves according to the following criteria:

For the short-wavelength half:

Use C_λ for $1.696 \leq \lambda \leq 2.692$.

For the long-wavelength half:

Use C_λ for $2.995 \leq \lambda \leq 5.45$.

The following sequence of events was used to prepare the data contained in this report. The objective of this process is to provide a reliable data base for the using community.

(1) Scans prior to tip off were plotted and reviewed. The best scans were 27 through 56, omitting scan 31. Reasons for omitting scans are:

(a) Excessive drift,

(b) TM drop out,

(c) Calibration source on during scan.

(2) Scans 27 to 30, 32 to 56 were co-added point by point (points 1 through 1225) for both gain channels of TM volts. The standard deviation for both co-added sets (29 points for each set) were computed and plotted).

(3) Zero reset voltages and standard deviations were computed for points 32 through 38 for scans 27 to 30, 32 to 56 and Chauvenet's criterion was used to omit unwanted points. The mean zero resets were listed for each scan.

(4) Mean zero reset voltages for each scan were subtracted from all TM voltage points in scans 27 to 30, 32 to 56 and the scan co-adding process was repeated. The co-added noise spectra were approximately 50 mV in both co-added computations and therefore the need to correct the data was alleviated.

4.3 Measured Altitude Emission Profiles

The altitude emission profiles are determined from the scans shown in Appendix C. The peak values at the wavelength of interest are plotted as a function of altitude. In Figure 1, this altitude profile is plotted for the CO_2 emission.

In Figure 6, an altitude profile is shown for N_2O in a band averaged between 4.55 μm and 4.61 μm. The signal to noise ratio for this measurement is less than one and no trend for signal is observed. In Figure 7 an altitude profile is shown for CO_2 in a band averaged between 4.78 μm and 4.93 μm which begins to show a trend in signal above the minimum detectable signal for altitudes below 70 km. In Figure 8 an altitude profile is shown for NO (v = 1) emission in a band averaged between 5.25 μm and 5.35 μm which shows a constant signal level. The shaded area has been drawn on these plots to aid the eye in reading the data. These measurements are consistent with previously reported data.[6,7] In the preliminary summary of previous ICECAP probes[6] the 5.3 μm emission was observed to be a

6. Stair, A.T., Jr., Ulwick, J.C., Baker, K.D., and Baker, D.J. (1975) Rocketborne observations of atmospheric infrared emissions in the auroral region, Atmospheres of Earth and the Planets, ed. B.M. McCormac, D. Reidel Publishing Co., Dordrecht-Holland, pp. 335-346.

7. Markov, M.N., Grechko, G.M., Gubarev, A.A., Ivanov, Yu.S., Petrov, V.S. (1976) Infrared Radiation of Nitrogen Oxide in Upper Atmosphere, According to the Measurements from Salyut-4, (Preprint No. 8) USSR Acad. of Sci., Moscow USSR, pp. 1-18.

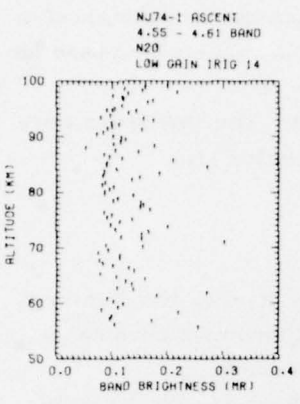


Figure 6. Altitude Profile for N_2O in a Band Averaged Between 4.55 μm and 4.61 μm

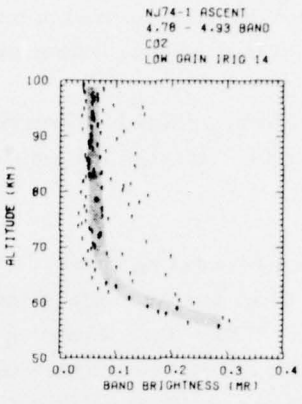


Figure 7. Altitude Profile for CO_2 in a Band Averaged Between 4.78 μm and 4.93 μm

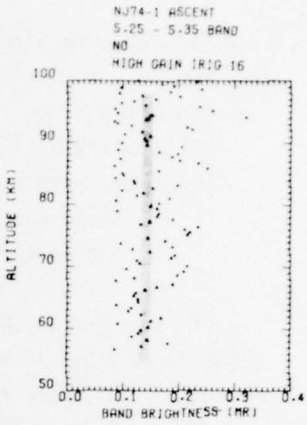


Figure 8. Altitude Profile for NO in a Band Averaged Between 5.25 μm and 5.35 μm

layer peaked at 130 to 140 km. The Russian literature[7] reported observing this radiation from a satellite limb look where the layer varied in peak altitude from 140 to 200 km. The wavelengths have been shifted by approximately 0.074 μm to allow the CO_2 peak to occur at 4.269 μm. This was done to be more consistent with later rocket aircraft data measurements.[8] Also evidence has been established that calibrations using fixed filters, such as those used in calibrating this CVF, can produce errors in wavelength of the order of 0.1 μm. This error is due to one's inability to determine the exact center of wavelength for the fixed filter whose response function is nonsymmetrical and irregular. This wavelength shift will help to avoid confusion when observing CVF data since there is strong evidence that this is the correct wavelength.

Other CO_2 emission profiles have been reported.[1,9,10] The low-gain channel IRIG 14 offset can be mostly compensated for by subtracting the zero background signal from the instrument. This offset in voltage for the low-gain channel IRIG 14, shown in Figure 9a, corresponds to a brightness level of approximately 3 MR/μm at 4.3 μm. Figure 10a. shows the high-gain IRIG 16 which has negligible offset.

8. Huppi, E.R., Rogers, J.W., and Stair, A.T., Jr. (1974) Aircraft observations of the infrared emission of the atmosphere in the 700-2800 cm^{-1} region, Applied Optics 13:1466.

9. Stair, A.T., Jr., Short Wavelength Infrared Spectral Measurements in an IBC-II Aurora Using a Rocket-Borne CVF Spectrometer – Rocket Number A18.219-1, HAES (Icecap Series) AFGL Report, to be published.

10. Nadile, R., Rocket Measured Auroral and Sunlit Enhanced Atmospheric Emissions in the Medium Wavelength Infrared Bands, Rocket Numbers IC 507.11-1A, 2A, and 3, to be published.

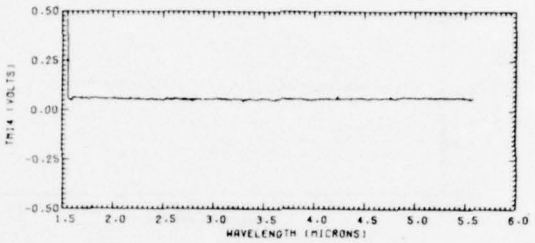


Figure 9a. Co-added Background Scans with No Zero Reset Correction for the Low-Gain Channel

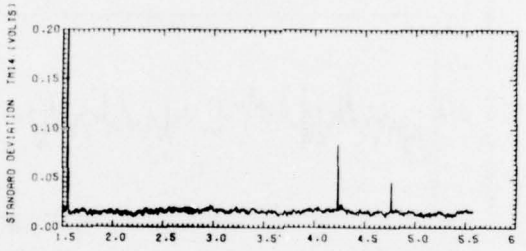


Figure 9b. Standard Deviation for Scan 9a

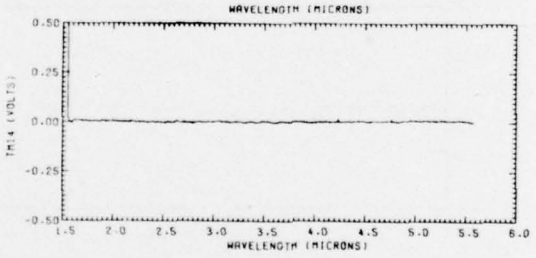


Figure 9c. Co-added Background Scan with Zero Reset Correction Applied for the Low-Gain Channel

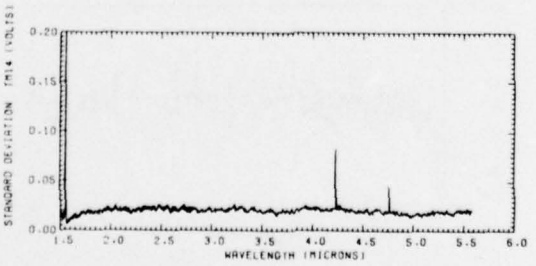


Figure 9d. Standard Deviation for Scan 9c

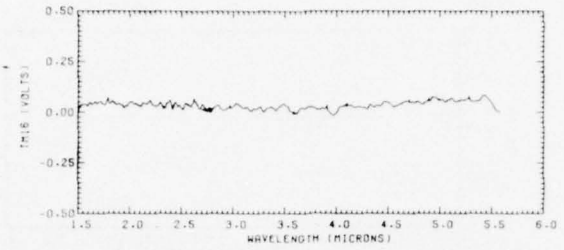


Figure 10a. Co-added Background Scans with No Zero Reset Correction for the High-Gain Channel

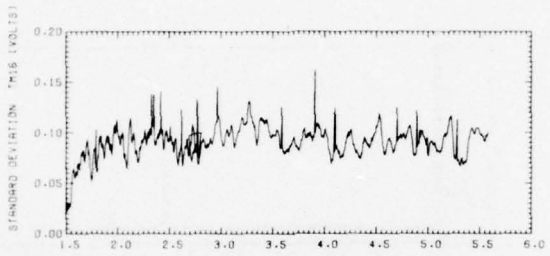


Figure 10b. Standard Deviation for Scan 10a

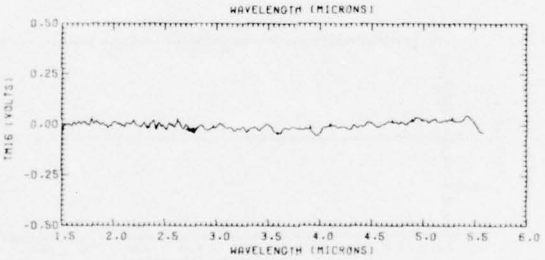


Figure 10c. Co-added Background Scans with Zero Reset Correction Applied for the High-Gain Channel

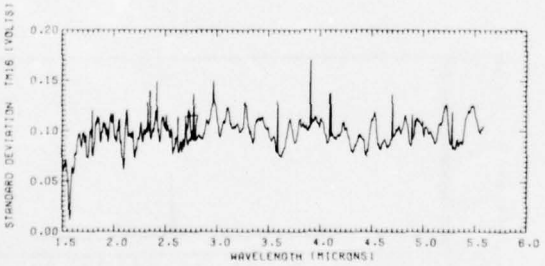


Figure 10d. Standard Deviation for Scan 10c

Another example concerning data analysis is given in Figure 11 where composite scans for the CO_2 peak are plotted on the low-gain channel during ascent. This plot is useful when it is desired to observe a trend in wavelength shift with altitude. It should be remembered that altitude increases from top to bottom in the figure.

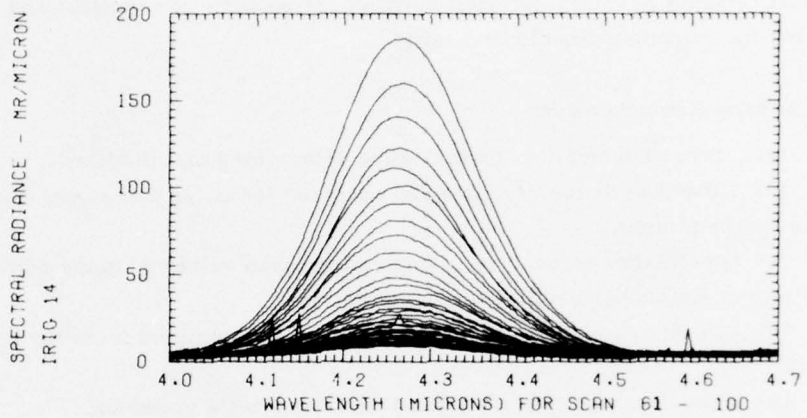


Figure 11. Composite Scans of the 4.3 μm Band for the Low-Gain Channel During Ascent

4.4 Magnetometer Aspect Data Reduction

In reference to Figure 5 and the explanation given in Section 3.1 concerning this figure, the total coning angle during the measuring portion of the flight did not exceed approximately 3 deg. The angle α held fairly constant ranging from approximately 23.5 deg at 50 km to approximately 28.5 deg at 116 km for ascent. The descent curve shows approximately the same coning angle during the measuring portion of the flight but begins to deviate greatly at approximately 90 km where the rocket begins to tip over. The angle between the rocket axis vector and the vertical cannot be found without more information about the rocket, except in the case where the rocket axis vector is known to be in the plane of the true vertical and the earth's magnetic field vector. If the radiation source profile can be predicted accurately enough as a function of altitude, a trial and error matching technique can be used.[5] However, these data cannot be processed using the technique described because CO_2 at 4.3 μm is optically thick. An optically thick medium as a radiating source provides a relatively steady signal as coning motion proceeds. In contrast to this an optically thin medium as a radiating source will produce modulation or fluctuation in the signal as coning motion is experienced.

This is obvious when one considers that obliquely viewed regions have greater optical depth and therefore greater radiating energy as compared with a vertical measurement. Another point of interest concerning optically thin NO^+, whose center wavelength is slightly higher than CO_2 which is an optically thick medium, is that an apparent wavelength shift can occur depending upon which radiating source has the highest excitation as a function of altitude. However, in these measurements NO^+ was not excited by an active auroral condition and its effect on the measurement should be negligible.

4.5 Summary of Data Processing

(a) Scale size and data format were determined and finalized.

(b) Individual scans of data were analyzed for noise and signal content; useful scans were plotted.

(c) Quiet scans were used to determine mean values of noise and standard deviations for background level determinations.

(d) The zero reset sampling criteria were determined from the computer plots.

(e) Acceptance of data was based on Chauvenet's criterion.

The conclusions reached from the above analysis were as follows:

(a) Zero reset voltages were subtracted from each scan to give more accurate absolute radiance levels.

(b) Offset voltages were not subtracted from each scan because:

(1) Offset voltages were approximately the same as the system noise level and therefore do not add in a significant way to the error in reading absolute radiance levels.

(2) Offset voltages appear to be different before and after the cover is removed from the instrument but are less than the noise equivalent radiance of the instrument.

(c) Error bar curves were superimposed on two sample scans shown in Figure 12 to assist in determining useful data. These error bars were determined by measuring the saturation voltage and the noise equivalent voltage of the instrument when converted to radiance as a function of wavelength. A study of the processes previously explained can be made by observing a sequence of plots beginning with Figure 13. This figure depicts individual scans for both low-gain (IRIG 14) and high-gain (IRIG 16) channels. An overlap in wavelength occurs at 2.75 μm due to the common wavelengths at the mating edges of the filter halves. The approximate noise for the low-gain channel is 50 mV peak-to-peak for scan 19 and approximately 250 mV peak-to-peak for the high-gain channel for scan 18.

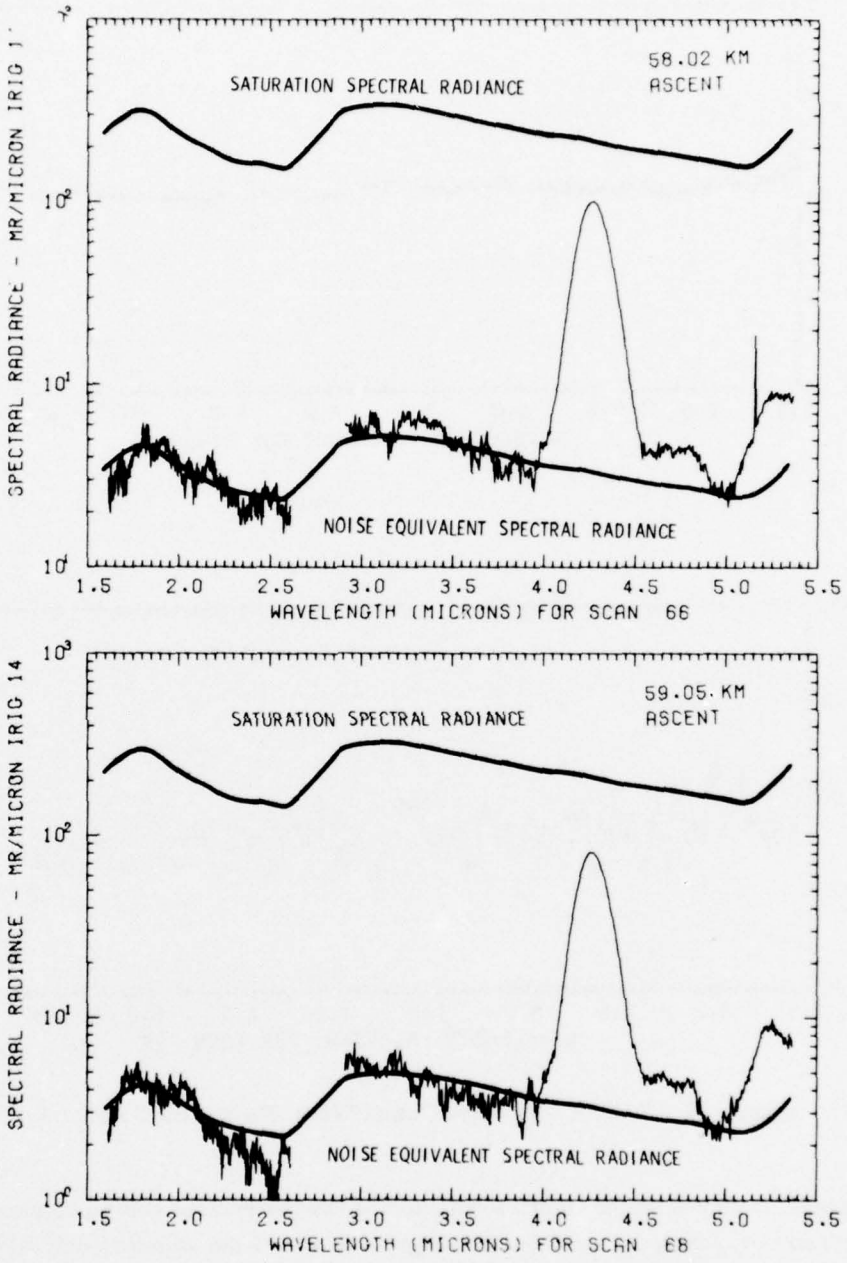


Figure 12. High and Low Spectral Radiance Limits for Data Analysis

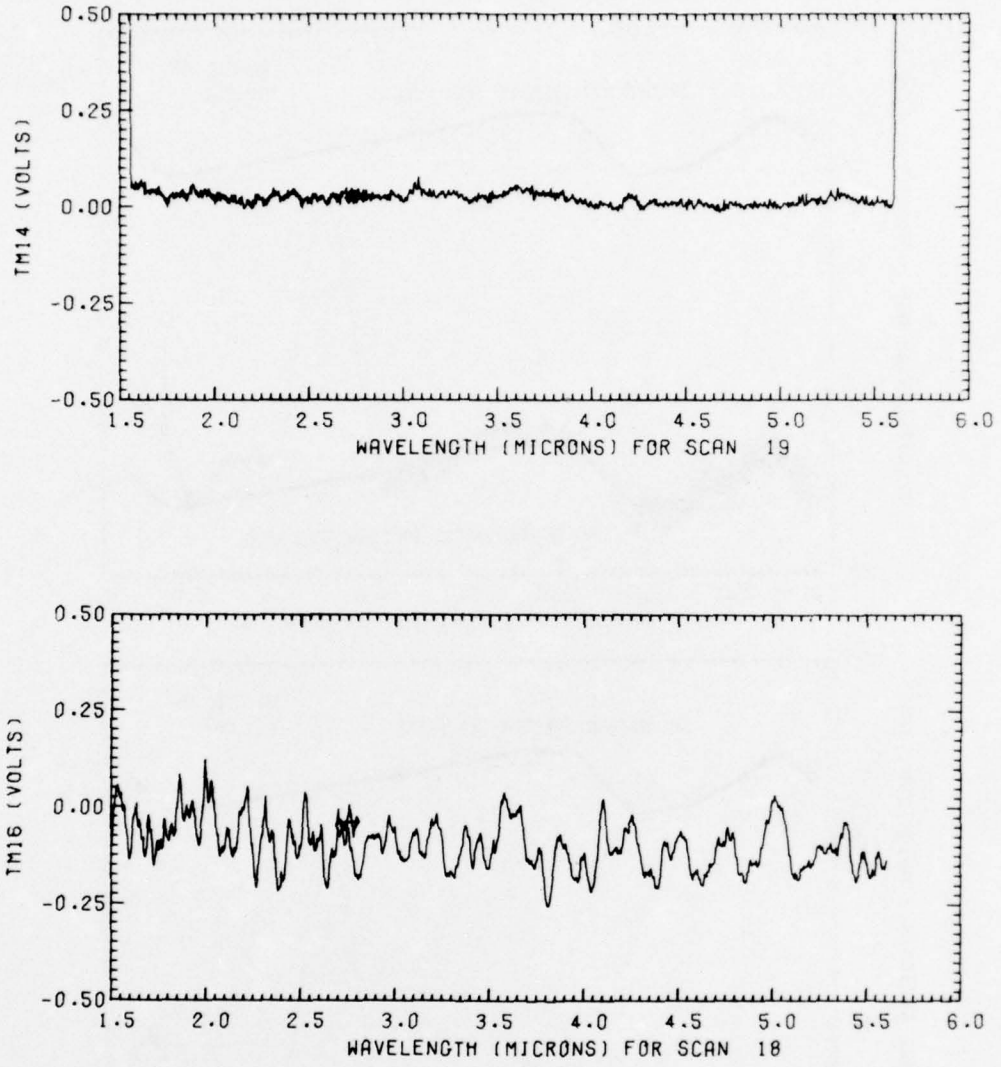


Figure 13. Sample CVF Data Output Wave Form with No Signal

Figure 9a shows the co-added scans before the instrument cap was removed and with no correction for zero reset. Figure 9b shows the standard deviation for this co-added plot. Figure 9c shows the same plot as Figure 9a with the exception that the zero reset portion of the scan occurring at 1.55 μm has been corrected to read zero. This zero reset portion of the scan is the true instrument zero since the detector is looking at a cold mask on the filter during this time period.

Figure 9d shows the standard deviation for the plot shown in Figure 9c. Two noise spikes occur in these scans and the standard deviation plots magnify these perturbations dramatically. Figures 10a, b, c, d follow the same reasoning as described above for Figures 9a, b, c, d except that the high-gain channel is shown. It is clear from these plots that the co-adding process reduces the noise considerably and provides a clear indication on the low-gain channel as to where the zero reset position of the filter occurs.

5. DISCUSSION

5.1 Summary of Data Analysis

Low-level data obtained from each scan depend upon the analyst's ability to distinguish the source response from the system noise. This can be approached by realizing that the system can produce certain types of perturbations that limit the ability to identify spectral features and determine spectral radiance levels. These perturbations include zero offset, drift, instrument noise, and system noise. The zero offset and long term drift are determined by co-adding techniques. The instrument noise can be observed during calibration since the calibration equipment noise is negligible. The system noise can be determined during a complete system cold-cap (minimum radiation) test. This can be accomplished because all noise producing equipment such as TM, and so forth, is included during this measurement. The data analysis can proceed after confidence in each scan has been obtained and limits for background noise and saturation levels have been applied.

6. CONCLUSIONS

The following list shows the conclusions reached as a result of preliminary data reduction and analysis described in this report.

(1) The instrument performed within the design tolerances.

(2) The offset voltage, which would produce an error in absolute spectral radiance, did not exceed 0.0 75 V. Since the noise equivalent voltage is 0.5 V no correction was made for this effect.

(3) The observed wavelength for CO_2 was 4.34 μm at 60 km ascent. However, the CO_2 emission in the 4.3 μm band should peak around 4.26 μm when convolved with the CVF spectral resolution.[11] Further evidence that the CO_2 emission occurs closer to 4.26 μm is present in later rocket flights.[6]

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11. Baker, D.J., Wyatt, C.L., Pendleton, W.R., Jr., and Ulwick, J.C. (1974) Rocket Launch of a SWIR Spectrometer Into an Aurora (ICECAP 72), AFCRL-TR-74-0077, HAES Report No. 1.

(4) Procedures and techniques used in calibrating these instruments have been modified and improved since this measurement was made.

(5) The descent data for the CO_2 emission were not presented because of high background, erratic and noisy signals.

(6) The altitude profile in Figure 1 shows a very distinct knee in the curve between 86 and 90 km. The level of this knee ranges from approximately 2.5 MR at 90 km to 3 MR at 86 km. This feature is currently being interpreted as being due to vibrationally excited hydroxyl (the chemiluminescent airglow) collisionally transferring vibrational energy to N_2 and subsequently to the ν_3 fundamental of CO_2.[12]

(7) Before reading any individual scan one should observe the noise equivalent spectral radiance curve given in Figure 12 so that background or noise signals are not assumed to be real data.

(8) The measurements of this rocket flight were made during a quiet auroral condition. This is the first and only measurement at the present time for a quiet auroral condition on the wavelength region at 1.5 to 6 μm.

12. Kumer, J. B., Wheeler, N. B., and Stair, A. T., Jr. (1976) Transactions of A. G. U., Fall Meeting, 1976.

References

1. Baker, K. D., Baker, D. J., Ulwick, J. C., and Stair, A. T., Jr., Rocketborne Measurements of Infrared Enhancements Associated with a Bright Auroral Breakup, Rocket No. A10.205-2, HAES Rpt No. 50 (ICECAP Series) to be published.

2. Jensen, L. L., Kemp, J. C., and Bell, R. J. (1972) Small Rocket Instrumentation for Measurements of Infrared Emissions – Astrobee D 30.205-3 and Astrobee D 30.205-4, AFCRL-TR-0691, Scientific Report No. 3, AFCRL Contract F19628-70-C-0302, Center for Research in Aeronomy, Utah State University.

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6. Stair, A. T., Jr., Ulwick, J. C., Baker, K. D., and Baker, D. J. (1975) Rocketborne observations of atmospheric infrared emissions in the auroral region, Atmospheres of Earth and the Planets, ed. B. M. McCormac, D. Reidel Publishing Co., Dordrecht-Holland, pp. 335-346.

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10. Nadile, R., Rocket Measured Auroral and Sunlit Enhanced Atmospheric Emissions in the Medium Wavelength Infrared Bands, Rocket Numbers IC 507.11-1A, 2A, and 3, to be published.

11. Baker, D.J., Wyatt, C.L., Pendleton, W.R., Jr., and Ulwick, J.C. (1974) Rocket Launch of a SWIR Spectrometer Into an Aurora (ICECAP 72), AFCRL-TR-74-0077, HAES Report No. 1.

12. Kumer, J.B., Wheeler, N.B., and Stair, A.T., Jr. (1976) Transactions of A.G.U., Fall Meeting, 1976.

Appendix A

Tabulations of Rocket Data

IRIG 16 brightness values for the 4.3 μm data.

14 AUGUST 1975

SCAN	INDEX	ALTITUDE	LAMBDA	BR15
60	933	55.2794	4.2541	22.3486
61	932	55.8061	4.2530	22.3310
62	932	56.3317	4.2530	22.4135
63	933	56.8543	4.2541	22.3662
64	932	57.3753	4.2530	22.3425
65	933	57.8935	4.2507	22.4501
66	934	58.4113	4.2656	22.4154
67	936	58.9250	4.2713	22.2654
68	941	59.4387	4.2907	22.2213
69	940	59.9475	4.2896	22.2830
70	933	60.4520	4.2541	22.5812
71	933	60.9567	4.2541	22.9240
72	932	61.4598	4.2530	23.0568
73	936	61.9619	4.2713	23.1378
74	938	62.4603	4.2840	22.9982
75	942	62.9569	4.2883	23.0602
76	941	63.4518	4.2942	23.1588
77	944	63.9445	4.3044	22.9703
78	947	64.4347	4.3216	22.9955
79	952	64.9237	4.3409	22.7965
80	953	65.4086	4.3491	21.3366
81	953	65.8915	4.3455	19.3844
82	953	66.3716	4.3491	18.4614
83	954	66.8504	4.3536	17.5007
84	955	67.3260	4.3547	15.3486
85	953	67.7995	4.3526	14.4404
86	955	68.2706	4.3511	14.4521
87	952	68.7391	4.3409	13.6546
88	954	69.2070	4.3572	11.8525
89	952	69.6707	4.3480	11.9558
90	952	70.1330	4.3374	11.6646
91	951	70.5930	4.3399	10.0780
92	952	71.0516	4.3480	10.6893
93	953	71.5066	4.3455	9.3480
94	955	71.9615	4.3547	9.4078
95	952	72.4117	4.3409	8.4899
96	955	72.8621	4.3582	7.7651
97	950	73.3067	4.3353	7.8627
98	957	73.7537	4.3602	7.1597
99	953	74.1949	4.3526	6.3535
100	953	74.6340	4.3491	6.7689

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	BR16
101	951	75.0705	4.3364	6.3733
102	951	75.5066	4.3364	6.1751
103	945	75.9379	4.3125	6.3915
104	952	76.3714	4.3409	6.0826
105	947	76.7986	4.3216	5.8344
106	948	77.2249	4.3262	6.2778
107	952	77.6509	4.3480	6.0387
108	951	78.0717	4.3328	5.5075
109	950	78.4922	4.3289	5.4511
110	949	78.9089	4.3237	7.0097
111	952	79.3259	4.3409	5.7728
112	949	79.7381	4.3308	5.9115
113	947	80.1478	4.3216	5.1104
114	952	80.5580	4.3409	5.2654
115	948	90.9632	4.3262	5.7135
116	944	81.3659	4.3044	5.2239
117	947	81.7690	4.3216	4.9528
118	949	82.1688	4.3308	5.1194
119	950	82.5669	4.3283	5.5372
120	946	82.9612	4.3135	4.9788
121	947	83.3543	4.3251	4.9166
122	946	83.7447	4.3135	5.2112
123	946	84.1329	4.3170	5.5454
124	950	84.5207	4.3318	5.2045
125	947	84.9036	4.3216	6.0145
126	949	85.2854	4.3237	5.7466
127	948	85.6655	4.3262	4.7391
128	945	86.0417	4.3125	4.6814
129	948	86.4176	4.3262	4.8791
130	952	86.7911	4.3409	4.8649
131	947	87.1603	4.3181	4.5692
132	947	87.5291	4.3181	4.8999
133	947	87.8950	4.3216	4.5259
134	954	88.2609	4.3536	3.6789
135	953	88.6217	4.3455	3.7065
136	953	88.9816	4.3491	3.8539
137	945	89.3362	4.3160	3.1809
138	951	89.6920	4.3328	2.9887
139	944	90.0431	4.3044	3.0856
140	948	90.3948	4.3262	1.8442
141	945	90.7420	4.3090	3.5651
142	949	91.0893	4.3308	2.7142
143	944	91.4314	4.3044	2.3340
144	948	91.7741	4.3227	2.3651
145	942	92.1118	4.2957	1.9254
146	945	92.4494	4.3125	2.1956
147	937	92.7818	4.2759	1.0118
148	944	93.1161	4.3044	1.6542
149	951	93.4485	4.3364	1.1715
150	948	93.7758	4.3262	1.3762
151	953	94.1028	4.3491	1.7210
152	951	94.4256	4.3364	2.0988
153	945	94.7454	4.3125	2.1029
154	943	95.0635	4.3033	1.3388
155	947	95.3815	4.3181	1.6744
156	975	95.7031	4.4460	.5367
157	946	96.0085	4.3135	2.0260

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	BR16
158	949	96.3189	4.3308	1.6783
159	946	96.6264	4.3170	.0301
160	953	96.9331	4.3455	2.9187
161	942	97.2341	4.3023	1.3066
162	953	97.5374	4.3491	1.2599
163	936	97.8324	4.2644	.9813
164	948	98.1322	4.3227	.4069
165	938	98.4245	4.2805	1.4278
166	949	98.7190	4.3308	.8435
167	935	99.0054	4.2633	1.2643
168	944	99.2951	4.3044	.3342
169	959	99.5846	4.3729	1.8779
170	974	99.8709	4.4487	0.0000
171	975	100.1520	4.4497	.4768
172	973	100.4301	4.4369	.0878
173	939	100.6988	4.2850	.4116
174	934	100.9718	4.2622	1.1874
175	954	101.2482	4.3501	.6080
176	932	101.5134	4.2530	.6623
177	944	101.7833	4.3044	.2805
178	965	102.0533	4.4003	.7181
179	938	102.3108	4.2770	.5145
180	954	102.5747	4.3536	.2361
181	952	102.8327	4.3374	.4894
182	948	103.0888	4.3297	.8015
183	963	103.3455	4.3912	.7102
184	945	103.5936	4.3125	.7492
185	946	103.8430	4.3135	.3260
186	946	104.0908	4.3206	.3445
187	961	104.3384	4.3785	.2112
188	967	104.5828	4.4131	1.0129
189	966	104.8229	4.4049	2.0504
190	965	105.0614	4.4039	1.1933
191	955	105.2952	4.3547	.4781
192	964	105.5310	4.3994	1.2154
193	957	105.7612	4.3602	.3251
194	946	105.9890	4.3135	.2095
195	965	106.2194	4.4075	.6471
196	937	106.4393	4.2724	.9507
197	933	106.6611	4.2541	1.0382
198	956	106.8858	4.3628	.7927
199	948	107.1027	4.3262	1.2947
200	936	107.3166	4.2678	2.4933
201	956	107.5336	4.3592	.8135
202	956	107.7454	4.3628	.3114
203	950	107.9536	4.3318	2.0595
204	932	108.1576	4.2530	1.2837
205	971	108.3688	4.4314	.3193
206	976	108.5721	4.4470	0.0000
207	934	108.7655	4.2656	1.6590
208	940	108.9644	4.2861	1.3655
209	933	109.1592	4.2541	.1612
210	933	109.3527	4.2541	.4639
211	963	109.5490	4.4020	.2450
212	933	109.7331	4.2507	1.1964
213	935	109.9206	4.2633	1.6245
214	960	110.1090	4.3775	.0428

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	BR16
215	972	110.2931	4.4359	1.8045
216	946	110.4692	4.3135	1.1301
217	968	110.6506	4.4177	.8164
218	942	110.8222	4.2953	1.0490
219	954	110.9977	4.3501	.2625
220	964	111.1700	4.3994	.5102
221	946	111.3363	4.3135	.8568
222	946	111.5032	4.3170	1.0842
223	975	111.6713	4.4460	0.0000
224	952	111.8306	4.3445	.3747
225	934	111.9881	4.2622	.5681
226	976	112.1514	4.4470	0.0000
227	945	112.3030	4.3125	.6764
228	959	112.4579	4.3729	.9909
229	941	112.6066	4.2907	.6003
230	975	112.7597	4.4497	.6218
231	939	112.9019	4.2815	1.2355
232	968	113.0495	4.4141	.4491
233	958	113.1905	4.3755	.4675
234	954	113.3297	4.3465	1.2279
235	957	113.4678	4.3638	.3962
236	961	113.6034	4.3856	.7760
237	974	113.7380	4.4451	.3500
238	975	113.8687	4.4460	0.0000
239	974	113.9971	4.4451	.6067
240	956	114.1216	4.3628	1.1510
241	946	114.2447	4.3100	1.0031
242	938	114.3660	4.2770	.7563
243	954	114.4872	4.3536	1.4414
244	963	114.6054	4.3948	1.1477
245	935	114.7179	4.2633	.6062
246	975	114.8346	4.4460	0.0000
247	933	114.9414	4.2576	.1106
248	950	115.0514	4.3318	1.7287
249	975	115.1598	4.4460	1.9151
250	933	115.2603	4.2541	1.0570
251	975	115.3655	4.4460	0.0000
252	963	115.4641	4.3984	1.2367
253	961	115.5610	4.3821	2.1915
254	936	115.6540	4.2713	.1036
255	949	115.7479	4.3272	.0561
256	959	115.8391	4.3801	.2539
257	952	115.9267	4.3409	.9949
258	943	116.0121	4.2998	1.4091
259	973	116.0981	4.4478	0.0000
260	936	116.1772	4.2609	.8870
261	972	116.2589	4.4359	.7032
262	951	116.3347	4.3399	.0898
263	953	116.4095	4.3420	.1739
264	947	116.4819	4.3181	.7982
265	974	116.5537	4.4487	0.0000
266	964	116.6212	4.3958	1.7277
267	964	116.6871	4.3958	1.0881
268	944	116.7498	4.3044	1.2781
269	950	116.8114	4.3389	.4604
270	976	116.8717	4.4470	0.0000

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	BR16
271	955	116.9278	4.3582	.9375
272	975	116.9833	4.4460	.8489
273	947	117.0346	4.3216	.1338
274	968	117.0856	4.4141	.7265
275	934	117.1322	4.2587	.0777
276	957	117.1788	4.3638	.2264
277	935	117.2215	4.2667	1.3483
278	952	117.2634	4.3445	1.4464
279	946	117.3022	4.3100	.7481
280	973	117.3398	4.4405	.3072
281	963	117.3740	4.3984	1.2340
282	971	117.4064	4.4242	.8425
283	975	117.4365	4.4460	0.0000
284	975	117.4643	4.4497	0.0000
285	975	117.4898	4.4497	0.0000
286	971	117.5130	4.4278	1.2942
287	959	117.5330	4.3729	.4775
288	947	117.5525	4.3181	.4999
289	966	117.5694	4.4085	.6248
290	964	117.5837	4.3958	.3379
291	968	117.5958	4.4177	.7779
292	970	117.6057	4.4232	.3108
293	942	117.6131	4.2953	.5024
294	970	117.6186	4.4268	.4666
295	933	117.6217	4.2541	.3912
296	948	117.6227	4.3227	1.0343
297	948	117.6214	4.3262	.1113
298	968	117.6177	4.4069	.3098
299	946	117.6120	4.3206	.6475
300	966	117.6038	4.4049	.2656
301	973	117.5934	4.4405	.3332
302	949	117.5812	4.3272	1.0881
303	952	117.5664	4.3445	.2929
304	945	117.5495	4.3090	1.1266
305	975	117.5298	4.4460	0.0000
306	939	117.5089	4.2850	1.0602
307	949	117.4850	4.3272	.0513
308	975	117.4585	4.4497	.4911
309	948	117.4309	4.3227	1.0530
310	943	117.4006	4.3033	.4616
311	933	117.3682	4.2541	.4233
312	967	117.3322	4.4095	.1418
313	942	117.2959	4.2986	.4719
314	955	117.2561	4.3582	1.0496
315	960	117.2143	4.3775	.5783
316	952	117.1706	4.3409	1.0495
317	974	117.1238	4.4415	.8115
318	940	117.0766	4.2896	.8749
319	957	117.0254	4.3638	1.1329
320	957	116.9724	4.3638	.3480
321	936	116.9183	4.2713	.3910
322	937	116.8610	4.2724	.8161
323	953	116.8006	4.3526	.3957
324	933	116.7399	4.2507	.0329
325	964	116.6742	4.3994	.7605

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	BR16
326	947	116.6089	4.3216	.4383
327	937	116.5409	4.2689	.4308
328	974	116.4679	4.4487	.0329
329	940	116.3970	4.2861	.9100
330	946	116.3214	4.3206	.4708
331	939	116.2444	4.2815	1.0205
332	973	116.1624	4.4333	1.2230
333	957	116.0815	4.3673	.3439
334	937	115.9987	4.2724	1.3086
335	975	115.9095	4.4497	1.2379
336	957	115.8221	4.3673	.9025
337	934	115.7329	4.2552	.4865
338	933	115.6398	4.2576	.2918
339	969	115.5417	4.4186	.8566
340	947	115.4457	4.3216	.4460
341	975	115.3436	4.4497	0.0000
342	956	115.2429	4.3592	.2133
343	938	115.1401	4.2805	.7655
344	958	115.0320	4.3684	1.2104
345	971	114.9217	4.4278	.1038
346	965	114.8111	4.4003	.9960
347	949	114.6993	4.3343	.7723
348	946	114.5841	4.3170	1.3113
349	959	114.4652	4.3694	.5006
350	975	114.3433	4.4460	.6311
351	932	114.2254	4.2530	.7013
352	975	114.0964	4.4497	0.0000
353	941	113.9732	4.2907	1.0665
354	976	113.8404	4.4470	0.0000
355	971	113.7095	4.4386	.3285
356	976	113.5759	4.4470	0.0000
357	964	113.4412	4.4029	.9817
358	933	113.3069	4.2541	.5042
359	948	113.1649	4.3227	.3381
360	942	113.0231	4.2988	.6659
361	934	112.8793	4.2587	.7034
362	957	112.7296	4.3638	.9399
363	975	112.5783	4.4497	0.0000
364	974	112.4269	4.4415	1.4135
365	958	112.2752	4.3719	.2563
366	938	112.1220	4.2805	.2665
367	945	111.9630	4.3125	.7827
368	952	111.8018	4.3409	.4483
369	943	111.6402	4.2998	.2441
370	944	111.4753	4.3044	.2776
371	969	111.3045	4.4222	.5706
372	948	111.1384	4.3262	1.2662
373	974	110.9630	4.4451	1.0089
374	933	110.7952	4.2541	.6493
375	958	110.6156	4.3684	.5955
376	961	110.4367	4.3821	.8490
377	933	110.2600	4.2576	1.0079
378	975	110.0711	4.4497	.9477
379	941	109.8913	4.2907	.2598
380	936	109.7048	4.2713	.7142

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	BR16
381	940	109.5147	4.2861	1.7946
382	941	109.3229	4.2942	.3086
383	952	109.1274	4.3409	1.0087
384	952	108.9309	4.3409	.2846
385	968	108.7299	4.4213	.4497
386	954	108.5316	4.3465	.1698
387	936	108.3314	4.2713	.6037
388	959	108.1228	4.3801	.4445
389	939	107.9185	4.2815	.9220
390	967	107.7042	4.4059	.8681
391	951	107.4949	4.3364	.9608
392	957	107.2796	4.3709	.3199
393	947	107.0651	4.3216	.7753
394	942	106.8474	4.2953	2.3083
395	936	106.6276	4.2713	.6100
396	949	106.4024	4.3272	.8219
397	937	106.1750	4.2794	.9667
398	961	105.9473	4.3785	.6060
399	964	105.7164	4.3958	.9060
400	948	105.4875	4.3333	1.8047
451	943	90.6834	4.3068	3.9585
452	945	90.3351	4.3055	5.0104
453	950	89.9823	4.3357	5.1423
454	943	89.6315	4.3033	4.4807
455	950	89.2743	4.3318	5.8024
456	953	88.9161	4.3455	4.4969
457	945	88.5585	4.3090	5.0500
458	951	88.1945	4.3435	4.9327
459	950	87.8306	4.3353	5.7218
460	948	87.4650	4.3191	6.6428
461	951	87.0948	4.3399	6.2569
462	945	86.7258	4.3125	6.4743
463	947	86.3525	4.3216	5.8455
464	948	85.9765	4.3227	6.5378
465	942	85.6006	4.2953	6.3939
466	946	85.2197	4.3170	6.2687
467	947	84.8370	4.3181	6.5644
468	947	84.4528	4.3216	8.3315
469	951	84.0649	4.3328	8.1106
470	948	83.6761	4.3297	8.5841
471	949	83.2852	4.3343	8.5127
472	954	82.8906	4.3501	8.3240
473	955	82.4949	4.3547	10.0674
474	954	82.0967	4.3536	15.0605
475	956	81.6965	4.3592	15.6333
476	932	81.3018	4.2530	23.1191
477	932	80.8978	4.2530	22.7696
478	932	80.4906	4.2530	22.2206
479	933	80.0820	4.2541	22.9700
480	491	79.8181	4.4418	0.0000
481	975	79.4476	4.4497	0.0000
482	978	79.0324	4.4489	0.0000
483	970	78.6165	4.4486	0.0000
484	978	78.1973	4.4489	0.0000
485	974	77.7756	4.4487	0.0000
486	972	77.3532	4.4468	0.0000
487	977	76.9268	4.4479	0.0000

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	RATIO
488	975	76.4980	4.4497	0.0000
489	974	76.0686	4.4497	0.0000
490	975	75.6357	4.4497	0.0000
491	978	75.2003	4.4489	0.0000
492	973	74.7633	4.4478	0.0000
493	976	74.3242	4.4470	0.0000
494	975	73.8819	4.4460	0.0000
495	975	73.4384	4.4497	0.0000
496	978	72.9909	4.4489	0.0000
497	972	72.5439	4.4468	0.0000
498	974	72.0940	4.4487	0.0000
499	978	71.6402	4.4489	0.0000
500	972	71.1861	4.4468	0.0000
401	954	105.2521	4.3501	.4531
402	942	105.0181	4.2918	1.2113
403	963	104.7750	4.3984	1.3081
404	955	104.5356	4.3547	.4902
405	947	104.2939	4.3216	.4346
406	951	104.0476	4.3339	1.2004
407	940	103.8020	4.2861	.2752
408	934	103.5532	4.2622	.8536
409	956	103.2969	4.3628	.8823
410	958	103.0419	4.3719	.8468
411	953	102.7863	4.3420	.6824
412	937	102.5303	4.2759	.0658
413	947	102.2670	4.3216	.4547
414	942	102.0048	4.2953	1.7001
415	958	101.7359	4.3684	1.0790
416	961	101.4670	4.3856	.3580
417	971	101.1948	4.4314	.6667
418	954	100.9264	4.3536	1.7935
419	946	100.6535	4.3135	1.5607
420	952	100.3751	4.3445	2.3811
421	948	100.0967	4.3227	1.5749
422	945	99.8160	4.3090	.9656
423	954	99.5304	4.3572	1.0155
424	956	99.2447	4.3628	2.3716
425	942	98.9596	4.2953	.8790
426	942	98.6694	4.2988	1.6887
427	950	98.3750	4.3318	1.8160
428	947	98.0811	4.3181	1.3260
429	947	97.7837	4.3216	1.4338
430	948	97.4845	4.3262	1.6014
431	950	97.1823	4.3293	1.0791
432	946	96.8793	4.3170	1.9581
433	950	96.5723	4.3389	1.7391
434	956	96.2629	4.3521	2.4433
435	933	95.9581	4.2611	1.3053
436	956	95.6400	4.3592	1.9639
437	950	95.3258	4.3353	2.6746
438	945	95.0108	4.3090	2.3856
439	940	94.6919	4.2896	3.3971
440	941	94.3704	4.2907	2.0612
441	947	94.0447	4.3216	2.5808
442	942	93.7201	4.2953	3.0010
443	940	93.3921	4.2896	3.3479
444	941	93.0617	4.2907	3.7202

15 AUGUST 1975 PEAK BRIGHTNESS

SCAN	INDEX	ALTITUDE	LAMBDA	3R16
445	941	92.7283	4.2942	2.1954
446	949	92.3914	4.3308	3.6410
447	943	92.0556	4.2998	3.9002
448	950	91.7141	4.3318	4.3402
449	948	91.3727	4.3227	3.6622
450	945	91.0290	4.3125	3.5210

Appendix B

Rocket Aspect from Magnetometer Data

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
20.07	5.36	160.69	20.17	5.50	160.69	20.27	5.65	160.69
20.37	5.79	160.69	20.47	5.93	160.69	20.57	6.08	160.52
20.67	6.22	160.52	20.77	6.36	160.52	20.87	6.51	160.24
20.97	6.65	160.24	21.07	6.79	160.24	21.17	6.94	160.15
21.27	7.08	160.15	21.37	7.22	160.15	21.47	7.36	159.94
21.57	7.51	159.94	21.67	7.65	159.94	21.77	7.79	159.94
21.87	7.93	159.94	21.97	8.08	159.94	22.07	8.22	159.94
22.17	8.36	160.17	22.27	8.50	160.17	22.37	8.64	160.17
22.47	8.79	160.17	22.57	8.93	159.80	22.67	9.07	159.80
22.77	9.21	159.80	22.87	9.35	159.52	22.97	9.49	159.52
23.07	9.63	159.52	23.17	9.78	159.52	23.27	9.92	159.71
23.37	10.06	159.71	23.47	10.20	159.71	23.57	10.34	159.83
23.67	10.48	159.83	23.77	10.62	159.83	23.87	10.76	159.83
23.97	10.90	159.79	24.07	11.04	159.79	24.17	11.18	159.79
24.27	11.32	159.46	24.37	11.46	159.46	24.47	11.60	159.46
24.57	11.74	159.46	24.67	11.88	159.41	24.77	12.02	159.41
24.87	12.16	159.41	24.97	12.30	159.41	25.07	12.44	159.98
25.17	12.58	159.98	25.27	12.72	159.98	25.37	12.86	159.36
25.47	12.99	159.36	25.57	13.13	159.36	25.67	13.27	159.36
25.77	13.41	159.06	25.87	13.55	159.06	25.97	13.69	159.06
26.07	13.83	159.06	26.17	13.96	159.34	26.27	14.10	159.34
26.38	14.24	159.34	26.47	14.38	158.81	26.58	14.52	158.81
26.68	14.66	158.81	26.78	14.79	158.81	26.88	14.93	158.97
26.98	15.07	158.97	27.08	15.21	158.97	27.18	15.34	158.97
27.28	15.48	158.97	27.38	15.62	158.82	27.48	15.75	158.82
27.58	15.89	158.82	27.68	16.03	158.82	27.78	16.16	158.70
27.88	16.30	158.70	27.98	16.44	158.59	28.08	16.58	158.59
28.18	16.71	158.59	28.28	16.85	158.79	28.38	16.98	158.79
28.48	17.12	158.38	28.58	17.26	158.38	28.68	17.39	158.52
28.78	17.53	158.52	28.88	17.66	158.48	28.98	17.80	158.48
29.08	17.93	158.53	29.18	18.07	158.53	29.28	18.21	158.78
29.38	18.34	158.45	29.48	18.48	158.45	29.58	18.61	158.74
29.68	18.75	158.49	29.78	18.88	158.49	29.88	19.02	158.27
29.98	19.15	158.39	30.08	19.29	158.39	30.18	19.42	158.38
30.28	19.56	158.26	30.38	19.69	158.61	30.48	19.82	158.61
30.58	19.96	158.48	30.68	20.09	158.43	30.78	20.23	158.51
30.88	20.36	158.44	30.98	20.50	158.44	31.08	20.63	158.14
31.18	20.76	158.26	31.28	20.90	158.47	31.38	21.03	158.43
31.48	21.16	158.18	31.58	21.30	158.43	31.68	21.43	158.47
31.79	21.56	158.47	31.88	21.70	158.34	31.98	21.83	158.26
32.08	21.96	158.47	32.18	22.09	158.38	32.28	22.23	158.29
32.38	22.36	158.37	32.48	22.49	158.45	32.58	22.62	158.37
32.68	22.76	158.33	32.78	22.89	158.58	32.88	23.02	158.64
32.98	23.15	158.36	33.08	23.28	158.39	33.18	23.42	158.44
33.28	23.55	158.35	33.38	23.68	158.23	33.48	23.81	158.27
33.58	23.94	158.34	33.68	24.07	158.18	33.78	24.21	158.11
33.88	24.34	158.14	33.98	24.47	158.15	34.08	24.60	158.18
34.18	24.73	157.98	34.28	24.86	157.90	34.38	24.99	158.06
34.48	25.12	158.26	34.58	25.25	158.35	34.68	25.38	158.27
34.78	25.51	158.30	34.88	25.64	158.39	34.98	25.77	158.39

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
35.08	25.90	157.88	35.18	26.03	157.99	35.28	26.16	158.12
35.38	26.29	158.08	35.48	26.42	157.91	35.58	26.55	157.75
35.68	26.68	157.88	35.78	26.81	158.21	35.88	26.94	158.12
35.98	27.07	157.64	36.08	27.20	157.85	36.18	27.33	158.08
36.28	27.45	158.07	36.38	27.59	157.99	36.48	27.72	157.82
36.58	27.84	157.77	36.68	27.97	158.11	36.78	28.10	157.99
36.88	28.23	157.71	36.98	28.36	157.54	37.08	28.49	157.66
37.18	28.62	157.90	37.28	28.74	158.02	37.38	28.87	157.76
37.48	29.00	157.35	37.58	29.13	157.76	37.68	29.25	158.09
37.78	29.39	158.31	37.88	29.51	158.10	37.98	29.64	157.77
38.08	29.76	157.47	38.18	29.89	157.46	38.28	30.02	157.80
38.38	30.15	158.08	38.48	30.27	157.83	38.58	30.40	157.58
38.68	30.53	157.47	38.78	30.65	157.50	38.88	30.78	157.54
38.98	30.91	157.67	39.08	31.03	157.79	39.18	31.16	157.74
39.28	31.29	157.57	39.38	31.41	157.37	39.48	31.54	157.58
39.58	31.66	157.69	39.68	31.79	157.73	39.78	31.92	157.62
39.89	32.04	157.45	39.98	32.17	157.32	40.08	32.29	157.28
40.18	32.42	157.36	40.28	32.54	157.66	40.38	32.67	157.95
40.48	32.79	158.11	40.59	32.92	157.89	40.68	33.04	157.51
40.78	33.17	157.27	40.88	33.29	157.11	40.99	33.42	157.27
41.08	33.54	157.48	41.19	33.67	157.64	41.29	33.79	157.69
41.38	33.91	157.72	41.49	34.04	157.56	41.59	34.16	157.22
41.69	34.29	157.01	41.79	34.41	157.04	41.89	34.53	157.34
41.99	34.66	157.58	42.09	34.78	157.71	42.19	34.91	157.63
42.29	35.03	157.63	42.39	35.15	157.55	42.49	35.28	157.30
42.59	35.40	157.00	42.69	35.52	156.91	42.79	35.65	156.95
42.89	35.77	157.08	42.99	35.89	157.24	43.09	36.01	157.79
43.19	36.14	157.78	43.29	36.26	157.53	43.39	36.38	157.28
43.49	36.50	156.99	43.59	36.63	156.78	43.69	36.75	156.61
43.79	36.87	156.73	43.89	36.99	156.86	43.99	37.11	156.98
44.09	37.24	157.23	44.19	37.36	157.56	44.29	37.48	157.76
44.39	37.60	157.76	44.49	37.72	157.59	44.59	37.84	157.47
44.69	37.96	157.23	44.79	38.09	156.68	44.89	38.21	156.55
44.99	38.33	156.59	45.09	38.45	156.66	45.19	38.57	146.44
45.29	38.69	146.55	45.39	38.81	156.96	45.49	38.93	157.22
45.59	39.05	157.47	45.69	39.17	157.50	45.79	39.29	157.24
45.89	39.41	157.04	45.99	39.53	156.91	46.09	39.65	156.79
46.19	39.77	156.66	46.29	39.89	156.57	46.39	40.01	156.52
46.49	40.13	156.57	46.59	40.25	156.70	46.69	40.37	156.82
46.79	40.49	156.94	46.89	40.61	157.15	46.99	40.73	157.10
47.09	40.85	156.89	47.19	40.97	156.85	47.29	41.08	156.86
47.39	41.20	156.86	47.49	41.32	123.71	47.59	41.44	123.66
47.69	41.56	156.72	47.79	41.68	156.77	47.89	41.80	156.85
47.99	41.91	156.93	48.09	42.03	157.05	48.19	42.15	157.10
48.29	42.27	157.14	48.39	42.39	157.10	48.49	42.50	156.97
48.59	42.62	156.87	48.69	42.74	156.78	48.79	42.86	156.72
48.89	42.97	156.50	48.99	43.09	156.33	49.09	43.21	156.12
49.19	43.32	156.07	49.29	43.44	156.10	49.39	43.56	156.15
49.49	43.68	156.28	49.59	43.79	156.32	49.69	43.91	156.36
49.79	44.03	156.42	49.89	44.14	156.60	49.99	44.26	156.74

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
50.09	44.38	156.70	50.19	44.49	156.65	50.29	44.61	156.82
50.39	44.72	123.78	50.49	44.84	123.78	50.59	44.95	156.95
50.69	45.07	156.95	50.79	45.19	156.94	50.89	45.30	156.94
50.99	45.42	156.90	51.09	45.53	156.89	51.19	45.65	156.80
51.29	45.76	156.85	51.39	45.88	157.01	51.49	45.99	156.97
51.59	46.11	156.96	51.69	46.22	156.96	51.79	46.34	156.97
51.89	46.45	156.93	51.99	46.57	156.84	52.09	46.68	156.74
52.19	46.79	156.78	52.29	46.91	156.88	52.39	47.02	156.86
52.49	47.14	156.84	52.59	47.25	156.71	52.69	47.36	156.70
52.79	47.48	156.74	52.89	47.59	156.61	52.99	47.71	156.61
53.09	47.82	156.70	53.19	47.93	156.65	53.29	48.05	156.65
53.39	48.16	156.70	53.49	48.27	156.79	53.59	48.39	156.91
53.69	48.50	156.91	53.79	48.61	156.90	53.89	48.72	156.97
53.99	48.84	156.97	54.09	48.95	156.95	54.19	49.06	156.91
54.29	49.17	156.90	54.39	49.29	156.93	54.49	49.40	156.89
54.59	49.51	156.81	54.69	49.62	156.73	54.79	49.74	158.77
54.89	49.85	158.68	54.99	49.96	156.51	55.09	50.07	156.42
55.19	50.18	156.21	55.29	50.29	156.04	55.39	50.40	155.96
55.49	50.52	155.87	55.59	50.63	155.70	55.69	50.74	155.60
55.79	50.85	155.51	55.89	50.96	155.52	56.00	51.07	155.56
56.10	51.18	155.56	56.20	51.29	155.48	56.30	51.40	155.42
56.40	51.51	155.50	56.50	51.62	155.55	56.60	51.73	155.59
56.70	51.84	155.68	56.80	51.95	155.73	56.90	52.06	155.81
57.00	52.17	155.94	57.10	52.28	156.05	57.20	52.39	156.18
57.30	52.50	156.30	57.40	52.61	156.42	57.50	52.72	156.46
57.60	52.83	156.56	57.70	52.94	156.77	57.80	53.05	156.81
57.90	53.16	156.94	58.00	53.27	157.07	58.10	53.38	157.06
58.20	53.49	157.06	58.30	53.59	157.07	58.40	53.70	157.11
58.50	53.81	157.15	58.60	53.92	157.10	58.70	54.03	157.06
58.80	54.14	156.97	58.90	54.24	156.88	59.00	54.35	156.75
59.10	54.46	156.57	59.20	54.57	156.49	59.30	54.68	156.38
59.40	54.78	156.25	59.50	54.89	156.12	59.60	55.00	155.95
59.70	55.11	155.82	59.80	55.21	155.69	59.90	55.32	155.52
60.00	55.43	155.47	60.10	55.54	155.43	60.20	55.64	155.43
60.30	55.75	155.38	60.40	55.86	155.34	60.50	55.96	155.39
60.60	56.07	155.42	60.70	56.18	155.46	60.80	56.28	155.46
60.90	56.39	155.45	61.00	56.49	155.53	61.10	56.60	155.55
61.20	56.71	155.57	61.30	56.81	155.66	61.40	56.92	155.62
61.50	57.02	155.66	61.60	57.13	155.82	61.70	57.24	155.96
61.80	57.34	156.01	61.90	57.45	156.05	62.00	57.55	156.09
62.10	57.66	156.09	62.20	57.76	156.13	62.30	57.87	156.18
62.40	57.97	156.21	62.50	58.08	156.28	62.60	58.18	156.29
62.70	58.29	156.30	62.80	58.39	156.34	62.90	58.50	156.26
63.00	58.60	156.21	63.10	58.70	156.21	63.20	58.81	157.23
63.30	58.91	157.19	63.40	59.02	156.29	63.50	59.12	156.42
63.60	59.22	156.52	63.70	59.33	156.56	63.80	59.43	156.58
63.90	59.54	156.66	64.00	59.64	156.70	64.10	59.74	156.87
64.20	59.85	156.92	64.30	59.95	156.92	64.40	60.05	157.09
64.50	60.15	157.16	64.60	60.26	157.07	64.70	60.36	157.08
64.80	60.46	157.04	64.90	60.57	157.04	65.00	60.67	157.12

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
65.10	60.77	157.12	65.20	60.87	157.12	65.30	60.98	157.08
65.40	61.08	157.04	65.50	61.18	157.08	65.60	61.28	157.03
65.70	61.38	156.99	65.80	61.48	157.03	65.90	61.59	156.98
66.00	61.69	156.94	66.10	61.79	156.95	66.20	61.89	156.95
66.30	61.99	156.90	66.40	62.09	156.90	66.50	62.20	156.86
66.60	62.30	156.73	66.70	62.40	156.68	66.80	62.50	156.58
66.90	62.60	156.50	67.00	62.70	156.42	67.10	62.80	156.33
67.20	62.90	156.25	67.30	63.00	156.16	67.40	63.10	156.08
67.50	63.20	155.99	67.60	63.30	155.85	67.70	63.40	155.76
67.80	63.50	123.09	67.90	63.60	123.04	68.00	63.70	155.64
68.10	63.80	155.47	68.20	63.90	155.39	68.30	64.00	155.38
68.40	64.10	155.32	68.50	64.20	155.20	68.60	64.30	155.16
68.70	64.40	155.12	68.80	64.50	155.03	68.90	64.59	154.99
69.00	64.69	154.94	69.10	64.79	154.86	69.20	64.89	154.77
69.30	64.99	154.68	69.40	65.09	154.68	69.50	65.19	154.64
69.60	65.28	154.50	69.71	65.38	154.50	69.80	65.48	154.59
69.90	65.58	154.54	70.00	65.68	154.46	70.11	65.77	154.46
70.20	65.87	154.46	70.30	65.97	154.49	70.40	66.07	154.58
70.51	66.15	154.63	70.60	66.26	154.63	70.70	66.36	154.62
70.80	66.46	154.62	70.90	66.55	154.66	71.01	66.65	154.69
71.11	66.75	154.57	71.21	66.84	154.56	71.31	66.94	154.68
71.41	67.04	154.78	71.51	67.13	154.77	71.61	67.23	154.78
71.71	67.33	154.81	71.81	67.42	154.84	71.91	67.52	154.82
72.01	67.62	154.87	72.11	67.71	154.91	72.21	67.81	154.91
72.31	67.90	154.86	72.41	68.00	154.82	72.51	68.10	154.86
72.61	68.19	154.86	72.71	68.29	154.86	72.81	68.38	154.85
72.91	68.48	154.84	73.01	68.57	154.90	73.11	68.67	154.90
73.21	68.76	154.86	73.31	68.86	154.94	73.41	68.95	154.90
73.51	69.05	154.77	73.61	69.14	154.81	73.71	69.23	154.89
73.81	69.33	155.04	73.91	69.42	155.13	74.01	69.52	155.15
74.11	69.61	155.15	74.21	69.71	155.19	74.31	69.80	155.26
74.41	69.89	155.26	74.51	69.99	155.28	74.61	70.08	155.27
74.71	70.17	155.27	74.81	70.27	155.35	74.91	70.36	155.53
75.01	70.45	155.57	75.11	70.55	155.57	75.21	70.64	155.65
75.31	70.73	155.70	75.41	70.83	155.73	75.51	70.92	155.82
75.61	71.01	155.91	75.71	71.11	155.95	75.81	71.20	155.95
75.91	71.29	156.03	76.01	71.38	156.12	76.11	71.48	156.16
76.21	71.57	156.16	76.31	71.66	156.15	76.41	71.75	156.20
76.51	71.84	156.20	76.61	71.94	156.28	76.71	72.03	156.32
76.81	72.12	156.31	76.91	72.21	156.32	77.01	72.30	156.28
77.11	72.39	156.32	77.21	72.48	156.28	77.31	72.58	156.23
77.41	72.67	156.27	77.51	72.76	156.27	77.61	72.85	156.28
77.71	72.94	156.28	77.81	73.03	156.19	77.91	73.12	156.15
78.01	73.21	156.23	78.11	73.30	156.31	78.21	73.39	156.18
78.31	73.48	156.06	78.41	73.57	156.05	78.51	73.66	156.08
78.61	73.75	156.09	78.71	73.84	156.13	78.81	73.93	156.13
78.91	74.02	156.04	79.01	74.11	156.00	79.11	74.20	155.96
79.21	74.29	155.96	79.31	74.38	155.87	79.41	74.47	155.74
79.51	74.55	155.74	79.61	74.65	155.73	79.71	74.74	155.56
79.81	74.82	155.47	79.91	74.91	155.43	80.01	75.00	155.35

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
80.11	75.09	155.30	80.21	75.18	155.22	80.31	75.27	155.26
80.41	75.36	155.21	80.51	75.44	155.20	80.61	75.53	155.20
80.71	75.62	155.08	80.81	75.71	155.03	80.91	75.80	154.97
81.01	75.88	154.85	81.11	75.97	154.78	81.21	76.06	154.82
81.31	76.15	154.67	81.41	76.23	154.58	81.51	76.32	154.60
81.61	76.41	154.51	81.71	76.50	154.46	81.81	76.58	154.41
81.91	76.67	154.37	82.01	76.76	154.23	82.11	76.84	154.18
82.21	76.93	154.14	82.31	77.02	154.10	82.41	77.10	154.02
82.51	77.19	154.00	82.61	77.28	153.96	82.71	77.36	153.84
82.81	77.45	153.80	82.91	77.53	153.73	83.01	77.62	153.64
83.11	77.71	153.62	83.21	77.79	153.61	83.31	77.88	153.57
83.41	77.95	153.40	83.51	78.05	153.26	83.61	78.13	153.26
83.71	78.22	153.26	83.81	78.30	153.17	83.91	78.39	153.12
84.01	78.47	153.12	84.11	78.56	153.17	84.21	78.64	153.08
84.31	78.73	152.90	84.41	78.81	152.85	84.51	78.90	152.84
84.61	78.98	152.89	84.72	79.07	152.85	84.81	79.15	152.76
84.91	79.24	152.81	85.01	79.32	152.75	85.12	79.40	152.71
85.21	79.49	152.75	85.31	79.57	152.74	85.41	79.66	152.61
85.52	79.74	152.52	85.61	79.82	152.53	85.71	79.91	152.48
85.81	79.99	152.43	85.91	80.07	152.35	86.01	80.16	152.42
86.12	80.24	152.51	86.22	80.32	152.34	86.32	80.41	152.25
86.42	80.49	152.16	86.52	80.57	152.12	86.62	80.65	152.25
86.72	80.74	152.29	86.82	80.82	152.25	86.92	80.90	152.16
87.02	80.98	152.08	87.12	81.06	152.16	87.22	81.15	152.29
87.32	81.23	152.20	87.42	81.31	152.15	87.52	81.39	121.04
87.62	81.47	121.05	87.72	81.56	152.11	87.82	81.64	152.04
87.92	81.72	152.04	88.02	81.80	152.06	88.12	81.88	152.10
88.22	81.96	152.10	88.32	82.04	152.11	88.42	82.12	152.06
88.52	82.20	151.97	88.62	82.29	151.92	88.72	82.37	151.92
88.82	82.45	151.87	88.32	82.53	151.95	99.02	82.61	152.09
89.12	82.69	152.09	89.22	82.77	152.04	89.32	82.85	151.99
89.42	82.93	152.04	89.52	83.01	152.08	89.62	83.09	152.13
89.72	83.17	152.05	89.82	83.25	152.09	89.92	83.33	152.13
90.02	83.41	152.12	90.12	83.49	152.21	90.22	83.57	152.13
90.32	83.64	152.08	90.42	83.72	152.17	90.52	83.80	152.22
90.62	83.88	152.17	90.72	83.96	152.16	90.82	84.04	152.20
90.92	84.12	152.25	91.02	84.20	152.34	91.12	84.28	152.25
91.22	84.35	152.14	91.32	84.43	152.19	91.42	84.51	152.25
91.52	84.59	152.20	91.62	84.67	152.20	91.72	84.74	152.20
91.82	84.82	152.29	91.92	84.90	152.29	92.02	84.98	152.33
92.12	85.05	152.45	92.22	85.13	152.49	92.32	85.21	152.46
92.42	85.29	152.47	92.52	85.36	152.51	92.62	85.44	152.55
92.72	85.52	152.55	92.82	85.59	152.46	92.92	85.67	152.46
93.02	85.75	152.50	93.12	85.82	152.46	93.22	85.90	152.50
93.32	85.98	152.62	93.42	86.05	152.58	93.52	86.13	152.59
93.62	86.21	152.58	93.72	86.28	152.57	93.82	86.36	152.67
93.92	86.43	152.62	94.02	86.51	152.62	94.12	86.59	152.71
94.22	86.66	152.75	94.32	86.74	152.74	94.42	86.81	152.80
94.52	86.89	152.84	94.62	86.96	152.75	94.72	87.04	152.75
94.82	87.11	152.84	94.92	87.19	152.82	95.02	87.26	152.68

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
95.12	87.34	152.75	95.22	87.41	152.88	95.32	87.49	152.92
95.42	87.56	152.83	95.52	87.64	152.79	95.62	87.71	152.92
95.72	87.78	152.91	95.82	87.86	152.86	95.92	87.93	152.83
96.02	88.01	152.83	96.12	88.08	152.79	96.22	88.15	152.77
96.32	88.23	152.86	96.42	88.30	152.82	96.52	88.37	152.81
96.62	88.45	152.81	96.72	88.52	152.92	96.82	88.60	152.91
96.92	88.67	152.86	97.02	88.74	152.95	97.12	88.81	152.82
97.22	88.89	152.73	97.32	88.96	152.73	97.42	89.03	152.77
97.52	89.10	152.82	97.62	89.18	152.77	97.72	89.25	152.77
97.82	89.32	152.73	97.92	89.39	152.73	98.02	89.47	152.76
98.12	89.54	152.62	98.22	89.61	152.58	98.32	89.68	152.63
98.42	89.75	152.58	98.52	89.83	152.63	98.62	89.90	152.53
98.72	89.97	152.48	98.82	90.04	152.44	98.92	90.11	152.45
99.02	90.18	152.46	99.12	90.25	152.46	99.22	90.32	152.42
99.32	90.39	152.45	99.42	90.47	152.44	99.52	90.54	152.48
99.62	90.61	152.44	99.72	90.68	152.37	99.82	90.75	152.31
99.92	90.82	152.24	100.02	90.89	152.20	100.12	90.96	152.16
100.22	91.03	152.17	100.33	91.10	152.17	100.42	91.17	152.03
100.52	91.24	151.94	100.62	91.31	151.85	100.73	91.38	151.85
100.82	91.45	151.85	100.92	91.52	151.81	101.02	91.59	151.90
101.13	91.66	151.76	101.23	91.73	151.66	101.33	91.79	151.75
101.43	91.86	151.75	101.53	91.93	151.75	101.63	92.00	151.70
101.73	92.07	151.57	101.83	92.14	151.52	101.93	92.21	151.47
102.03	92.27	151.47	102.13	92.34	151.47	102.23	92.41	151.33
102.33	92.48	151.24	102.43	92.55	151.25	102.53	92.62	151.29
102.63	92.68	151.29	102.73	92.75	151.19	102.83	92.82	151.06
102.93	92.89	150.97	103.03	92.95	151.00	103.13	93.02	151.09
103.23	93.09	151.10	103.33	93.16	150.97	103.43	93.22	150.92
103.53	93.29	150.87	103.63	93.36	150.87	103.73	93.42	150.86
103.83	93.49	150.82	103.93	93.56	150.78	104.03	93.62	150.73
104.13	93.69	150.71	104.23	93.76	150.71	104.33	93.82	150.77
104.43	93.89	150.73	104.53	93.96	150.59	104.63	94.02	150.45
104.73	94.09	150.53	104.83	94.15	150.58	104.93	94.22	150.55
105.03	94.28	150.59	105.13	94.35	150.50	105.23	94.42	150.50
105.33	94.48	150.54	105.43	94.55	150.49	105.53	94.61	150.43
105.63	94.68	150.40	105.73	94.74	150.35	105.83	94.81	150.36
105.93	94.87	150.36	106.03	94.94	150.30	106.13	95.00	150.25
106.23	95.06	150.25	106.33	95.13	150.25	106.43	95.19	150.25
106.53	95.26	150.21	106.63	95.32	150.21	106.73	95.39	150.30
106.83	95.45	150.30	106.93	95.51	150.21	107.03	95.58	150.26
107.13	95.64	150.16	107.23	95.70	150.12	107.33	95.77	150.20
107.43	95.83	150.11	107.53	95.90	150.11	107.63	95.96	150.11
107.73	96.02	150.06	107.83	96.08	150.15	107.93	96.15	150.28
108.03	96.21	150.33	108.13	96.27	150.34	108.23	96.34	150.37
108.33	96.40	150.28	108.43	96.46	150.23	108.53	96.52	150.33
108.63	96.59	150.36	108.73	96.65	150.35	108.83	96.71	150.19
108.93	96.77	150.14	109.03	96.83	150.32	109.13	96.90	150.42
109.23	96.96	150.42	109.33	97.02	150.46	109.43	97.08	150.42
109.53	97.14	150.42	109.63	97.20	150.51	109.73	97.27	150.51
109.83	97.33	150.54	109.93	97.39	150.54	110.03	97.45	150.46

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
110.13	97.51	150.46	110.23	97.57	150.50	110.33	97.63	150.50
110.43	97.69	150.55	110.53	97.75	150.55	110.63	97.81	150.54
110.73	97.87	150.59	110.83	97.93	150.63	110.93	97.99	150.67
111.03	98.05	150.63	111.13	98.11	150.67	111.23	98.17	150.80
111.33	98.23	150.89	111.43	98.29	150.84	111.53	98.35	150.80
111.63	98.41	150.90	111.73	98.47	150.85	111.83	98.53	150.89
111.93	98.59	150.89	112.03	98.65	150.94	112.13	98.71	151.03
112.23	98.77	150.98	112.33	98.83	151.06	112.43	98.89	151.06
112.53	98.95	151.11	112.63	99.00	151.15	112.73	99.06	151.20
112.83	99.12	151.16	112.93	99.18	151.15	113.03	99.24	151.29
113.13	99.30	151.21	113.23	99.35	151.21	113.33	99.41	151.24
113.43	99.47	151.24	113.53	99.53	151.29	113.63	99.59	151.39
113.73	99.64	151.34	113.83	99.70	151.38	113.93	99.76	151.51
114.03	99.81	151.47	114.13	99.87	151.42	114.23	99.93	151.24
114.33	99.99	151.33	114.43	100.04	151.58	114.53	100.10	151.56
114.63	100.16	151.62	114.73	100.21	151.62	114.83	100.27	151.66
114.93	100.33	151.73	115.03	100.38	151.73	115.13	100.44	151.73
115.23	100.50	151.72	115.34	100.55	151.80	115.43	100.61	151.86
115.53	100.66	151.86	115.63	100.72	151.86	115.74	100.78	151.89
115.83	100.83	151.89	115.93	100.89	151.90	116.03	100.94	151.90
116.14	101.00	151.94	116.23	101.05	152.07	116.33	101.11	152.04
116.43	101.16	151.99	116.54	101.22	152.02	116.64	101.27	152.02
116.74	101.33	151.99	116.84	101.38	152.03	116.94	101.44	152.12
117.04	101.49	152.08	117.14	101.55	152.11	117.24	101.60	152.15
117.34	101.66	152.15	117.44	101.71	152.16	117.54	101.76	152.16
117.64	101.82	152.25	117.74	101.87	152.24	117.84	101.93	152.11
117.94	101.98	152.17	118.04	102.03	152.39	118.14	102.09	152.34
118.24	102.14	152.27	118.34	102.19	152.30	118.44	102.25	152.32
118.54	102.30	152.33	118.64	102.35	152.32	118.74	102.41	152.37
118.84	102.46	152.42	118.94	102.51	152.46	119.04	102.56	152.51
119.14	102.62	152.56	119.24	102.67	152.60	119.34	102.72	152.55
119.44	102.77	152.45	119.54	102.83	152.45	119.64	102.88	152.50
119.74	102.93	152.50	119.84	102.98	152.51	119.94	103.04	152.55
120.04	103.09	152.55	120.14	103.14	152.51	120.24	103.19	152.51
120.34	103.24	152.60	120.44	103.29	152.59	120.54	103.34	152.58
120.64	103.40	152.58	120.74	103.45	152.59	120.84	103.50	152.59
120.94	103.55	152.54	121.04	103.60	152.51	121.14	103.65	152.56
121.24	103.70	152.53	121.34	103.75	152.57	121.44	103.80	152.53
121.54	103.85	152.53	121.64	103.90	152.58	121.74	103.95	152.57
121.84	104.00	152.53	121.94	104.05	152.49	122.04	104.10	152.50
122.14	104.15	152.45	122.24	104.20	152.39	122.34	104.25	152.44
122.44	104.30	152.49	122.54	104.35	152.48	122.64	104.40	152.52
122.74	104.45	152.49	122.84	104.50	152.49	122.94	104.55	152.55
123.04	104.60	152.50	123.14	104.65	152.43	123.24	104.70	152.39
123.34	104.75	152.43	123.44	104.79	152.47	123.54	104.84	152.52
123.64	104.89	152.44	123.74	104.94	152.35	123.84	104.99	152.34
123.94	105.04	152.34	124.04	105.08	152.30	124.14	105.13	152.26
124.24	105.18	152.25	124.34	105.23	152.16	124.44	105.28	152.15
124.54	105.32	152.24	124.64	105.37	152.25	124.74	105.42	152.16
124.84	105.47	152.06	124.94	105.51	152.06	125.04	105.56	152.11

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
125.14	105.61	152.07	125.24	105.65	151.98	125.34	105.70	152.03
125.44	105.75	152.07	125.54	105.79	152.01	125.64	105.84	151.87
125.74	105.89	151.75	125.84	105.93	151.79	125.94	105.98	151.84
126.04	106.03	151.75	126.14	106.07	151.70	126.24	106.12	151.65
126.34	106.17	151.61	126.44	106.21	151.64	126.54	106.26	151.62
126.64	106.30	151.54	126.74	106.35	151.51	126.84	106.39	151.51
126.94	106.44	151.52	127.04	106.49	151.43	127.14	106.53	151.43
127.24	106.58	151.42	127.34	106.62	151.33	127.44	106.67	151.19
127.54	106.71	151.15	127.64	106.76	151.23	127.74	106.80	151.23
127.84	106.84	151.27	127.94	106.89	151.27	128.04	106.93	151.22
128.14	106.98	151.10	128.24	107.02	150.92	128.34	107.07	150.90
128.44	107.11	151.04	128.54	107.15	150.91	128.64	107.20	150.77
128.74	107.24	150.77	128.84	107.29	150.81	128.94	107.33	150.85
129.04	107.37	150.86	129.14	107.42	150.82	129.24	107.46	150.77
129.34	107.50	150.73	129.44	107.55	150.63	129.54	107.59	150.58
129.64	107.63	150.68	129.74	107.68	150.54	129.84	107.72	150.41
129.94	107.76	150.45	130.04	107.80	150.44	130.14	107.85	150.39
130.24	107.89	150.33	130.34	107.93	150.30	130.44	107.97	150.33
130.54	108.01	150.35	130.64	108.06	150.35	130.74	108.10	150.31
130.84	108.14	150.22	130.95	108.18	150.16	131.04	108.22	150.21
131.14	108.27	150.26	131.24	108.31	150.25	131.35	108.35	150.20
131.44	108.39	150.17	131.54	108.43	150.17	131.64	108.47	150.16
131.75	108.51	150.11	131.85	108.55	150.16	131.95	108.60	150.12
132.05	108.64	150.11	132.15	108.68	150.14	132.25	108.72	150.11
132.35	108.76	150.07	132.45	108.80	150.12	132.55	108.84	150.16
132.65	108.88	150.07	132.75	108.92	150.02	132.85	108.96	150.02
132.95	109.00	150.11	133.05	109.04	150.11	133.15	109.08	150.02
133.25	109.12	149.97	133.35	109.16	149.97	133.45	109.20	150.02
133.55	109.24	150.06	133.65	109.28	150.20	133.75	109.31	150.20
133.85	109.35	150.06	133.95	109.39	150.02	134.05	109.43	150.01
134.15	109.47	150.06	134.25	109.51	150.15	134.35	109.55	150.19
134.45	109.59	150.19	134.55	109.62	150.14	134.65	109.66	150.19
134.75	109.70	150.28	134.85	109.74	150.19	134.95	109.78	150.05
135.05	109.82	150.14	135.15	109.85	150.14	135.25	109.89	150.32
135.35	109.93	150.41	135.45	109.97	150.42	135.55	110.00	150.46
135.65	110.04	150.46	135.75	110.08	150.46	135.85	110.12	150.56
135.95	110.15	150.60	136.05	110.19	150.64	136.15	110.23	150.63
136.25	110.26	150.55	136.35	110.30	150.51	136.45	110.34	150.65
136.55	110.37	150.73	136.65	110.41	150.73	136.75	110.45	150.83
136.55	110.48	150.78	136.95	110.52	150.78	137.05	110.56	150.92
137.15	110.59	150.96	137.25	110.63	150.99	137.35	110.66	150.95
137.45	110.70	150.92	137.55	110.74	151.01	137.65	110.77	151.01
137.75	110.81	151.09	137.85	110.84	151.23	137.95	110.88	151.22
138.05	110.91	151.20	138.15	110.95	151.26	138.25	110.98	151.32
138.35	111.02	151.30	138.45	111.05	151.34	138.55	111.09	151.36
138.65	111.12	151.41	138.75	111.16	151.40	138.85	111.19	151.41
138.95	111.23	151.55	139.05	111.26	151.64	139.15	111.29	151.62
139.25	111.33	151.62	139.35	111.36	151.63	139.45	111.40	151.67
139.55	111.43	151.73	139.65	111.46	151.72	139.75	111.50	151.77
139.85	111.53	151.83	139.95	111.56	151.82	140.05	111.60	151.84

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
140.15	111.63	151.90	140.25	111.66	151.99	140.35	111.70	151.95
140.45	111.73	151.81	140.55	111.76	151.93	140.65	111.80	152.06
140.75	111.83	152.12	140.85	111.86	152.07	140.95	111.89	152.07
141.05	111.93	152.13	141.15	111.96	152.12	141.25	111.99	152.25
141.35	112.02	152.31	141.45	112.06	152.28	141.55	112.09	152.09
141.65	112.12	152.16	141.75	112.15	152.30	141.85	112.18	152.25
141.95	112.21	152.29	142.05	112.25	152.34	142.15	112.28	152.29
142.25	112.31	152.29	142.35	112.34	152.34	142.45	112.37	152.34
142.55	112.40	152.47	142.65	112.43	152.57	142.75	112.46	152.52
142.85	112.49	152.46	142.95	112.53	152.51	143.05	112.56	152.51
143.15	112.59	152.50	143.25	112.62	152.61	143.35	112.65	152.61
143.45	112.68	152.57	143.55	112.71	152.52	143.65	112.74	152.48
143.75	112.77	152.57	143.85	112.80	152.61	143.95	112.83	152.66
144.05	112.86	152.57	144.15	112.89	152.48	144.25	112.92	152.61
144.35	112.95	152.69	144.45	112.97	152.69	144.55	113.00	152.65
144.65	113.03	152.61	144.75	113.06	152.65	144.85	113.09	152.69
144.95	113.12	152.70	145.05	113.15	152.74	145.15	113.18	152.74
145.25	113.21	152.60	145.35	113.23	152.55	145.45	113.26	152.59
145.55	113.29	152.71	145.65	113.32	152.84	145.75	113.35	152.73
145.85	113.38	152.65	145.96	113.40	152.65	146.05	113.43	152.60
146.15	113.46	152.63	146.25	113.49	152.72	146.36	113.51	152.78
146.45	113.54	152.74	146.55	113.57	152.68	146.65	113.60	152.59
146.76	113.62	152.60	146.85	113.65	152.69	146.95	113.68	152.67
147.05	113.70	152.63	147.15	113.73	121.43	147.25	113.76	121.41
147.36	113.79	152.58	147.46	113.81	152.59	147.56	113.84	152.55
147.66	113.86	152.37	147.76	113.89	152.36	147.86	113.92	152.45
147.96	113.94	152.42	148.06	113.97	152.42	148.16	113.99	152.46
148.26	114.02	152.46	148.36	114.05	152.37	148.46	114.07	152.32
148.56	114.10	152.32	148.66	114.12	152.40	148.76	114.15	152.32
148.86	114.17	152.28	148.96	114.20	152.35	149.06	114.22	152.26
149.16	114.25	152.23	149.26	114.27	152.22	149.36	114.30	152.18
149.46	114.32	152.14	149.56	114.35	152.10	149.66	114.37	152.09
149.76	114.40	152.09	149.86	114.42	152.09	149.96	114.45	152.14
150.06	114.47	152.13	150.16	114.49	152.08	150.26	114.52	152.03
150.36	114.54	151.93	150.46	114.57	151.93	150.56	114.59	152.04
150.66	114.61	152.05	150.76	114.64	152.00	150.86	114.66	151.91
150.96	114.68	151.86	151.06	114.71	151.86	151.16	114.73	151.81
151.26	114.75	151.81	151.36	114.78	151.73	151.46	114.80	151.66
151.56	114.82	151.70	151.66	114.84	151.72	151.76	114.87	151.81
151.86	114.89	151.72	151.96	114.91	151.67	152.06	114.93	151.62
152.16	114.95	151.58	152.26	114.98	151.58	152.36	115.00	151.57
152.46	115.02	151.58	152.56	115.04	151.45	152.66	115.07	151.40
152.76	115.09	151.44	152.86	115.11	151.39	152.96	115.13	151.35
153.06	115.15	151.25	153.16	115.17	151.24	153.26	115.19	151.29
153.36	115.22	151.22	153.46	115.24	151.18	153.56	115.26	151.17
153.66	115.28	151.14	153.76	115.30	151.07	153.86	115.32	151.09
153.96	115.34	151.15	154.06	115.36	151.07	154.16	115.38	151.04
154.26	115.40	151.08	154.36	115.42	151.03	154.46	115.44	150.90
154.56	115.46	150.88	154.66	115.48	150.89	154.76	115.50	150.89
154.86	115.52	150.75	154.96	115.54	150.62	155.06	115.56	150.67

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
155.16	115.58	150.62	155.26	115.60	150.66	155.36	115.62	150.69
155.46	115.64	150.65	155.56	115.66	150.61	155.66	115.68	150.56
155.76	115.69	150.51	155.86	115.71	150.47	155.96	115.73	150.52
156.06	115.75	150.51	156.16	115.77	150.42	156.26	115.79	150.47
156.36	115.81	150.47	156.46	115.82	150.42	156.56	115.84	150.47
156.66	115.86	150.37	156.76	115.88	150.32	156.86	115.90	150.32
156.96	115.91	150.32	157.06	115.93	150.37	157.16	115.95	150.37
157.26	115.97	150.28	157.36	115.98	150.28	157.46	116.00	150.28
157.56	116.02	150.29	157.66	116.04	150.24	157.76	116.05	150.20
157.86	116.07	150.23	157.96	116.09	150.19	158.06	116.10	150.20
158.16	116.12	150.25	158.26	116.14	150.20	158.36	116.15	150.20
158.46	116.17	150.15	158.56	116.19	150.15	158.66	116.20	150.20
158.76	116.22	150.24	158.86	116.23	150.24	158.96	116.25	150.20
159.06	116.27	150.20	159.16	116.28	150.08	159.26	116.30	150.12
159.36	116.31	150.32	159.46	116.33	150.35	159.56	116.34	150.31
159.66	116.36	150.23	159.76	116.37	150.23	159.86	116.39	150.23
159.96	116.40	150.24	160.06	116.42	150.28	160.16	116.43	150.28
160.26	116.45	150.29	160.36	116.46	150.33	160.46	116.48	150.37
160.56	116.49	150.38	160.66	116.51	150.37	160.76	116.52	150.33
160.86	116.54	150.37	160.96	116.55	150.45	161.06	116.56	150.49
161.16	116.58	150.58	161.26	116.59	150.55	161.37	116.61	150.45
161.46	116.62	150.54	161.56	116.63	150.60	161.66	116.65	150.60
161.77	116.66	150.64	161.86	116.67	150.73	161.96	116.69	150.73
162.06	116.70	150.68	162.16	116.71	150.71	162.26	116.73	150.76
162.37	116.74	150.82	162.47	116.75	150.83	162.56	116.76	150.78
162.66	116.78	150.83	162.77	116.79	150.97	162.87	116.80	151.10
162.97	116.81	151.01	163.07	116.83	151.01	163.17	116.84	151.10
163.27	116.85	151.06	163.37	116.86	151.18	163.47	116.87	151.30
163.57	116.88	151.31	163.67	116.90	151.27	163.77	116.91	151.33
163.87	116.92	151.46	163.97	116.93	151.50	164.07	116.94	151.50
164.17	116.95	151.54	164.27	116.96	151.60	164.37	116.98	151.60
164.47	116.99	151.65	164.57	117.00	151.65	164.67	117.01	151.73
164.77	117.02	151.82	164.87	117.03	151.83	164.97	117.04	151.78
165.07	117.05	151.74	165.17	117.06	151.88	165.27	117.07	151.90
165.37	117.08	151.91	165.47	117.09	152.01	165.57	117.10	152.10
165.67	117.11	152.09	165.77	117.12	152.05	165.87	117.13	152.15
165.97	117.14	152.19	166.07	117.15	152.24	166.17	117.16	152.28
166.27	117.17	152.27	166.37	117.18	152.37	166.47	117.18	152.42
166.57	117.19	152.37	166.67	117.20	152.42	166.77	117.21	152.42
166.87	117.22	152.45	166.97	117.23	152.45	167.07	117.24	152.46
167.17	117.24	152.46	167.27	117.25	152.46	167.37	117.26	152.55
167.47	117.27	152.51	167.57	117.28	152.51	167.67	117.29	152.64
167.77	117.29	152.72	167.87	117.30	152.73	167.97	117.31	152.69
168.07	117.32	152.64	168.17	117.32	152.73	168.27	117.33	152.81
168.37	117.34	152.81	168.47	117.35	152.82	168.57	117.35	152.81
168.67	117.36	152.81	168.77	117.37	152.82	168.87	117.37	152.82
168.97	117.38	152.82	169.07	117.39	152.77	169.17	117.39	152.80
169.27	117.40	152.89	169.37	117.41	152.81	169.47	117.41	152.82
169.57	117.42	152.93	169.67	117.42	152.92	169.77	117.43	152.72
169.87	117.44	152.73	169.97	117.44	152.91	170.07	117.45	152.95

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
170.17	117.45	152.99	170.27	117.46	152.90	170.37	117.46	152.90
170.47	117.47	152.94	170.57	117.48	152.90	170.67	117.48	152.91
170.77	117.49	152.90	170.87	117.49	152.86	170.97	117.50	152.87
171.07	117.50	152.82	171.17	117.50	152.68	171.27	117.51	152.64
171.37	117.51	152.64	171.47	117.52	152.82	171.57	117.52	152.82
171.67	117.53	152.86	171.77	117.53	152.71	171.87	117.54	152.64
171.97	117.54	152.74	172.07	117.54	152.73	172.17	117.55	152.68
172.27	117.55	152.64	172.37	117.55	152.67	172.47	117.56	152.66
172.57	117.56	152.63	172.67	117.56	152.67	172.77	117.57	152.63
172.87	117.57	152.55	172.97	117.57	152.50	173.07	117.58	152.46
173.17	117.58	152.45	173.27	117.58	152.49	173.37	117.59	152.44
173.47	117.59	152.41	173.57	117.59	152.44	173.67	117.59	152.40
173.77	117.59	152.36	173.87	117.60	152.45	173.97	117.60	152.45
174.07	117.60	152.41	174.17	117.60	152.36	174.27	117.61	152.31
174.37	117.61	152.27	174.47	117.61	152.26	174.57	117.61	152.20
174.67	117.61	152.12	174.77	117.61	152.14	174.87	117.61	152.09
174.97	117.62	152.14	175.07	117.62	152.14	175.17	117.62	151.94
175.27	117.62	151.94	175.37	117.62	151.96	175.47	117.62	151.87
175.57	117.62	151.87	175.67	117.62	151.95	175.77	117.62	151.86
175.87	117.62	151.73	175.97	117.62	151.78	176.07	117.62	151.73
176.17	117.62	151.73	176.27	117.62	151.73	176.37	117.62	151.59
176.47	117.62	151.64	176.57	117.62	151.59	176.67	117.62	151.55
176.77	117.62	151.62	176.87	117.62	151.62	176.98	117.62	151.55
177.07	117.62	151.41	177.17	117.62	151.44	177.27	117.62	151.48
177.38	117.62	151.51	177.47	117.62	151.50	177.57	117.61	151.46
177.67	117.61	151.37	177.77	117.61	151.27	177.87	117.61	151.31
177.97	117.61	151.30	178.08	117.61	151.26	178.17	117.61	151.18
178.28	117.60	151.19	178.38	117.60	151.23	178.48	117.60	151.22
178.58	117.60	151.17	178.68	117.60	151.17	178.78	117.59	151.14
178.88	117.59	151.12	178.98	117.59	151.03	179.08	117.59	151.03
179.18	117.58	151.08	179.28	117.58	151.05	179.38	117.58	151.09
179.48	117.57	151.08	179.58	117.57	151.00	179.68	117.57	150.91
179.78	117.56	120.15	179.88	117.56	120.15	179.98	117.56	150.87
180.08	117.55	150.77	180.18	117.55	150.72	180.28	117.55	150.76
180.38	117.54	150.79	180.48	117.54	150.81	180.58	117.54	150.82
180.68	117.53	150.82	180.78	117.53	150.72	180.88	117.52	150.72
180.98	117.52	150.72	181.08	117.51	150.72	181.18	117.51	150.73
181.28	117.51	150.64	181.38	117.50	150.54	181.48	117.50	150.54
181.58	117.49	150.63	181.68	117.49	150.64	181.78	117.48	150.64
181.88	117.48	150.58	181.98	117.47	150.54	182.08	117.47	150.41
182.18	117.46	150.45	182.28	117.45	150.54	182.38	117.45	150.53
182.48	117.44	150.49	182.58	117.44	150.50	182.68	117.43	150.59
182.78	117.43	150.54	182.88	117.42	150.50	182.98	117.41	150.45
183.08	117.41	150.45	183.18	117.40	150.49	183.28	117.39	150.50
183.38	117.39	150.50	183.48	117.38	150.49	183.58	117.37	150.45
183.68	117.37	150.46	183.78	117.36	150.50	183.88	117.35	150.50
183.98	117.35	150.50	184.08	117.34	150.53	184.18	117.33	150.44
184.28	117.32	150.36	184.38	117.32	150.36	184.48	117.31	150.44
184.58	117.30	150.48	184.68	117.29	150.44	184.78	117.29	150.40
184.88	117.28	150.36	184.98	117.27	150.28	185.08	117.26	150.23

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
185.18	117.25	150.36	185.28	117.25	150.41	185.38	117.24	150.41
185.48	117.23	150.46	185.58	117.22	150.49	185.68	117.21	150.49
185.78	117.20	150.48	185.88	117.19	150.49	185.98	117.18	150.53
186.08	117.15	150.58	186.18	117.17	150.55	186.28	117.16	150.50
186.38	117.15	150.64	186.48	117.14	150.68	186.58	117.13	150.55
186.68	117.12	150.55	186.78	117.11	150.64	186.88	117.10	150.72
186.98	117.09	150.77	187.08	117.08	150.72	187.18	117.07	150.63
187.28	117.06	150.72	187.38	117.05	150.80	187.48	117.04	150.76
187.58	117.03	150.87	187.68	117.02	150.97	187.78	117.01	150.92
187.88	117.00	150.87	187.98	116.99	151.01	188.08	116.98	151.05
188.18	116.96	151.00	188.28	116.95	151.01	188.38	116.94	151.01
188.48	116.93	151.05	188.58	116.92	151.10	188.68	116.91	151.15
188.78	116.90	151.24	188.88	116.89	151.24	188.98	116.87	151.24
189.08	116.86	151.33	189.18	116.85	151.33	189.28	116.84	151.31
189.38	116.83	151.40	189.48	116.81	151.47	189.58	116.80	151.51
189.68	116.79	151.46	189.78	116.78	151.51	189.88	116.76	151.64
189.98	116.75	151.57	190.08	116.74	151.53	190.18	116.73	151.65
190.28	116.71	151.73	190.38	116.70	151.73	190.48	116.69	151.83
190.58	116.67	151.88	190.68	116.66	151.83	190.78	116.65	151.92
190.88	116.63	151.97	190.98	116.62	152.07	191.08	116.61	152.15
191.18	116.59	152.10	191.28	116.58	152.05	191.38	116.57	152.04
191.48	116.55	152.03	191.58	116.54	152.16	191.68	116.52	152.32
191.78	116.51	152.32	191.88	116.49	152.32	191.98	116.48	152.41
192.08	116.47	152.55	192.18	116.45	152.46	192.28	116.44	152.43
192.38	116.42	152.42	192.48	116.41	152.41	192.58	116.39	152.51
192.68	116.38	152.60	192.78	116.36	152.69	192.88	116.35	152.69
192.98	116.33	152.69	193.09	116.31	152.65	193.18	116.30	152.64
193.28	116.28	152.73	193.38	116.27	152.79	193.49	116.25	152.74
193.58	116.24	152.79	193.68	116.22	152.83	193.78	116.20	152.83
193.89	116.19	152.83	193.99	116.17	152.92	194.09	116.15	153.02
194.19	116.14	152.92	194.29	116.12	152.92	194.39	116.10	152.97
194.49	116.09	153.06	194.59	116.07	153.00	194.69	116.05	152.91
194.79	116.04	153.06	194.89	116.02	153.06	194.99	116.00	153.02
195.09	115.99	153.06	195.19	115.97	153.10	195.29	115.95	153.15
195.39	115.93	153.14	195.49	115.91	153.14	195.59	115.90	153.15
195.69	115.88	153.06	195.79	115.86	153.02	195.89	115.84	153.07
195.99	115.83	153.10	196.09	115.81	153.05	196.19	115.79	153.06
196.29	115.77	153.01	196.39	115.75	153.01	196.49	115.73	153.11
196.59	115.71	153.06	196.69	115.70	153.05	196.79	115.68	153.01
196.89	115.66	152.97	196.99	115.64	121.20	197.09	115.62	121.21
197.19	115.60	152.92	197.29	115.58	152.88	197.39	115.56	152.88
197.49	115.54	152.79	197.59	115.52	152.83	197.69	115.50	152.87
197.79	115.48	152.88	197.89	115.46	152.92	197.99	115.44	152.83
198.09	115.42	152.80	198.19	115.40	152.80	198.29	115.38	152.75
198.39	115.36	152.75	198.49	115.34	152.76	198.59	115.32	152.71
198.69	115.30	152.62	198.79	115.28	152.48	198.89	115.26	152.48
198.99	115.24	152.52	199.09	115.22	152.52	199.19	115.20	152.49
199.29	115.17	152.40	199.39	115.15	152.43	199.49	115.13	152.43
199.59	115.11	152.40	199.69	115.09	152.31	199.79	115.07	152.17
199.89	115.05	152.08	199.99	115.02	152.16	200.09	115.00	152.21

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
200.19	114.98	152.13	200.29	114.96	152.13	200.39	114.93	152.12
200.49	114.91	152.03	200.59	114.89	151.95	200.69	114.87	151.98
200.79	114.85	151.93	200.89	114.82	151.94	200.99	114.80	151.94
201.09	114.78	151.84	201.19	114.75	151.75	201.29	114.73	151.75
201.39	114.71	151.81	201.49	114.68	151.77	201.59	114.66	151.68
201.69	114.64	151.68	201.79	114.61	151.68	201.89	114.59	151.59
201.99	114.57	151.55	202.09	114.54	151.49	202.19	114.52	151.40
202.29	114.50	151.40	202.39	114.47	151.36	202.49	114.45	151.31
202.59	114.42	151.36	202.69	114.40	151.34	202.79	114.37	151.38
202.89	114.35	151.32	202.99	114.33	151.18	203.09	114.30	151.13
203.19	114.28	151.18	203.29	114.25	151.28	203.39	114.23	151.18
203.49	114.20	151.09	203.59	114.18	151.09	203.69	114.15	151.04
203.79	114.12	150.99	203.89	114.10	150.99	203.99	114.07	150.98
204.09	114.05	150.94	204.19	114.02	150.86	204.29	114.00	150.86
204.39	113.97	150.91	204.49	113.94	150.91	204.59	113.92	150.82
204.69	113.89	150.85	204.79	113.87	150.89	204.89	113.84	150.82
204.99	113.81	150.81	205.09	113.79	150.91	205.19	113.76	150.90
205.29	113.73	150.72	205.39	113.71	150.59	205.49	113.68	150.64
205.59	113.65	150.69	205.69	113.63	150.69	205.79	113.60	150.64
205.89	113.57	150.64	205.99	113.54	150.65	206.09	113.52	150.64
206.19	113.49	150.68	206.29	113.46	150.68	206.39	113.43	150.59
206.49	113.41	150.55	206.59	113.38	150.55	206.69	113.35	150.51
206.79	113.32	150.56	206.89	113.29	150.64	206.99	113.26	150.64
207.09	113.24	150.61	207.19	113.21	150.51	207.29	113.18	150.56
207.39	113.15	150.64	207.49	113.12	150.64	207.59	113.09	150.59
207.69	113.06	150.50	207.79	113.04	150.46	207.89	113.01	150.51
207.99	112.98	150.52	208.09	112.95	150.56	208.19	112.92	150.65
208.29	112.89	150.56	208.39	112.86	150.46	208.49	112.83	150.41
208.59	112.80	150.47	208.70	112.77	150.55	208.79	112.74	150.51
208.89	112.71	150.57	208.99	112.68	150.61	209.10	112.65	150.52
209.19	112.62	150.52	209.29	112.59	150.60	209.39	112.56	150,55
209.50	112.53	150.56	209.59	112.50	150.60	209.69	112.47	150.57
209.80	112.43	150.57	209.90	112.40	150.57	210.00	112.37	150.57
210.10	112.34	150.52	210.20	112.31	150.55	210.30	112.28	150.60
210.40	112.25	150.65	210.50	112.22	150.74	210.60	112.18	150.65
210.70	112.15	150.52	210.80	112.12	150.55	210.90	112.09	150.65
211.00	112.06	150.71	211.10	112.03	150.78	211.20	111.99	150.74
211.30	111.96	150.71	211.40	111.93	150.80	211.50	111.90	150.84
211.60	111.85	150.85	211.70	111.83	150.81	211.80	111.80	150.85
211.90	111.77	150.75	212.00	111.73	150.76	212.10	111.70	150.85
212.20	111.67	150.85	212.30	111.63	150.94	212.40	111.60	150.90
212.50	111.57	150.85	212.60	111.53	150.85	212.70	111.50	150.95
212.80	111.47	150.90	212.90	111.43	150.89	213.00	111.40	150.98
213.10	111.35	151.03	213.20	111.33	151.09	213.30	111.30	151.04
213.40	111.26	151.08	213.50	111.23	151.13	213.60	111.19	151.12
213.70	111.16	151.17	213.80	111.12	151.27	213.90	111.09	151.34
214.00	111.05	151.29	214.10	111.02	151.17	214.20	110.99	151.18
214.30	110.95	151.26	214.40	110.91	151.36	214.50	110.88	151.41
214.60	110.84	151.41	214.70	110.81	151.41	214.80	110.77	151.41
214.90	110.74	151.41	215.00	110.70	151.40	215.10	110.67	151.49

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
215.20	110.63	151.54	215.30	110.59	151.53	215.40	110.56	151.63
215.50	110.52	151.67	215.60	110.49	151.71	215.70	110.45	151.81
215.80	110.41	151.82	215.90	110.38	151.78	216.00	110.34	151.78
216.10	110.30	151.83	216.20	110.27	151.95	216.30	110.23	151.90
216.40	110.19	151.90	216.50	110.16	151.95	216.60	110.12	151.96
216.70	110.08	151.87	216.80	110.04	151.86	216.90	110.01	152.00
217.00	109.97	152.06	217.10	109.93	152.08	217.20	109.89	152.12
217.30	109.86	152.18	217.40	109.82	152.27	217.50	109.78	152.33
217.60	109.74	152.29	217.70	109.70	152.33	217.80	109.67	152.38
217.90	109.63	152.38	218.00	109.59	152.42	218.10	109.55	152.45
218.20	109.51	152.36	218.30	109.47	152.47	218.40	109.43	152.60
218.50	109.40	152.60	218.60	109.36	152.60	218.70	109.32	152.56
218.80	109.28	152.61	218.90	109.24	152.65	219.00	109.20	152.65
219.10	109.16	152.68	219.20	109.12	152.73	219.30	109.08	152.82
219.40	109.04	152.86	219.50	109.00	152.87	219.60	108.96	152.78
219.70	108.92	152.70	219.80	108.88	152.84	219.90	108.84	152.97
220.00	108.80	153.06	220.10	108.76	152.92	220.20	108.72	152.81
220.30	108.68	152.82	220.40	108.64	152.80	220.50	108.60	152.93
220.60	108.56	153.02	220.70	108.52	153.06	220.80	108.48	152.96
220.90	108.43	152.91	221.00	108.39	153.02	221.10	108.35	153.02
221.20	108.31	153.02	221.30	108.27	152.98	221.40	108.23	152.96
221.50	108.19	152.99	221.60	108.14	153.01	221.70	108.10	153.06
221.80	108.06	153.06	221.90	108.02	153.03	222.00	107.98	153.03
222.10	107.93	153.02	222.20	107.89	153.01	222.30	107.85	153.02
222.40	107.81	153.07	222.50	107.76	153.02	222.60	107.72	152.94
222.70	107.68	152.98	222.80	107.64	152.92	222.90	107.59	152.88
223.00	107.55	152.89	223.10	107.51	152.92	223.20	107.46	152.93
223.30	107.42	152.80	223.40	107.38	152.84	223.50	107.33	152.85
223.60	107.29	152.81	223.70	107.25	152.81	223.80	107.20	152.81
223.90	107.16	152.90	224.00	107.11	152.75	224.10	107.07	152.61
224.20	107.03	152.72	224.30	106.98	152.68	224.40	106.94	152.66
224.51	106.89	152.65	224.60	106.85	152.63	224.70	106.80	152.50
224.80	106.76	152.41	224.90	106.71	152.50	225.00	106.67	152.51
225.10	106.62	152.46	225.21	106.58	152.45	225.30	106.53	152.41
225.40	106.49	152.36	225.50	106.44	152.32	225.61	106.40	152.27
225.70	106.35	152.23	225.81	106.31	152.14	225.91	106.26	152.05
226.01	106.21	152.06	226.11	106.17	152.11	226.21	106.12	152.11
226.31	106.08	151.97	226.41	106.03	151.88	226.51	105.98	151.92
226.61	105.94	151.84	226.71	105.89	151.79	226.81	105.85	151.87
226.91	105.80	151.78	227.01	105.75	151.70	227.11	105.71	151.61
227.21	105.66	151.57	227.31	105.61	151.66	227.41	105.56	151.57
227.51	105.52	151.48	227.61	105.47	151.47	227.71	105.42	151.38
227.81	105.37	151.29	227.91	105.33	151.29	228.01	105.28	151.35
228.11	105.23	151.17	228.21	105.18	151.03	228.31	105.14	151.17
228.41	105.09	151.26	228.51	105.04	151.22	228.61	104.99	151.13
228.71	104.94	151.06	228.81	104.89	151.01	228.91	104.85	150.97
229.01	104.80	150.97	229.11	104.75	150.99	229.21	104.70	150.99
229.31	104.65	150.95	229.41	104.60	150.86	229.51	104.55	150.86
229.61	104.50	150.90	229.71	104.45	150.86	229.81	104.41	150.77
229.91	104.36	150.63	230.01	104.31	150.63	230.11	104.26	150.66

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
230.21	104.21	150.62	230.31	104.16	150.63	230.41	104.11	150.48
230.51	104.06	150.35	230.61	104.01	150.40	230.71	103.96	150.53
230.81	103.91	150.58	230.91	103.86	150.44	231.01	103.81	150.40
231.11	103.76	150.45	231.21	103.71	150.45	231.31	103.65	150.41
231.41	103.60	150.41	231.51	103.55	150.46	231.61	103.50	150.37
231.71	103.45	150.27	231.81	103.40	150.32	231.91	103.35	150.37
232.01	103.30	150.33	232.11	103.25	150.37	232.21	103.19	150.37
232.31	103.14	150.23	232.41	103.09	150.19	232.51	103.04	150.22
232.61	102.99	150.32	232.71	102.94	150.32	232.81	102.88	150.28
232.91	102.83	150.22	233.01	102.78	150.23	233.11	102.73	150.29
233.21	102.67	150.29	233.31	102.62	150.33	233.41	102.57	150.25
233.51	102.52	150.24	233.61	102.46	150.31	233.71	102.41	150.41
233.81	102.35	150.43	233.91	102.30	150.25	234.01	102.25	150.30
234.11	102.20	150.39	234.21	102.14	150.34	234.31	102.09	150.39
234.41	102.04	150.48	234.51	101.98	150.47	234.61	101.93	150.39
234.71	101.88	150.38	234.81	101.82	150.47	234.91	101.77	150.48
235.01	101.71	150.34	235.11	101.66	150.31	235.21	101.61	150.31
235.31	101.55	150.39	235.41	101.50	150.48	235.51	101.44	150.44
235.61	101.39	150.44	235.71	101.33	150.35	235.81	101.28	150.44
235.91	101.22	150.66	236.01	101.17	150.58	236.11	101.11	150.49
236.21	101.05	150.49	236.31	101.00	150.49	236.41	100.95	150.54
236.51	100.89	150.59	236.61	100.84	150.63	236.71	100.78	150.72
236.81	100.72	150.68	236.91	100.67	150.54	237.01	100.61	150.63
237.11	100.56	150.73	237.21	100.50	150.77	237.31	100.44	150.87
237.41	100.39	150.82	237.51	100.33	150.80	237.61	100.27	150.85
237.71	100.22	150.87	237.81	100.16	150.86	237.91	100.10	150.95
238.01	100.05	150.96	238.11	99.99	150.83	238.21	99.93	150.83
238.31	99.88	150.97	238.41	99.82	150.96	238.51	99.76	150.96
238.61	99.70	151.04	238.71	99.65	151.09	238.81	99.59	151.06
238.91	99.53	151.05	239.01	99.47	151.18	239.11	99.42	151.27
239.21	99.36	151.10	239.31	99.30	151.02	239.41	99.24	151.02
239.51	99.18	151.06	239.61	99.13	151.20	239.71	99.07	151.24
239.81	99.01	151.28	239.91	98.95	151.25	240.01	98.89	151.21
240.11	98.83	151.29	240.21	98.77	151.43	240.31	98.71	151.42
240.41	98.65	151.32	240.51	98.60	151.29	240.62	98.54	151.43
240.71	98.48	151.55	240.81	98.42	151.51	240.91	98.36	151.51
241.02	98.30	151.47	241.11	98.24	151.44	241.21	98.18	151.52
241.31	98.12	151.66	241.41	98.06	151.63	241.51	98.00	151.58
241.62	97.94	151.61	241.72	97.88	151.57	241.81	97.82	151.66
241.92	97.76	151.76	242.02	97.70	151.81	242.12	97.64	151.83
242.22	97.58	151.79	242.32	97.51	151.76	242.42	97.45	151.85
242.52	97.39	151.85	242.62	97.33	151.85	242.72	97.27	151.94
242.82	97.21	151.91	242.92	97.15	151.91	243.02	97.09	151.94
243.12	97.02	151.94	243.22	96.96	152.00	243.32	96.90	152.00
243.42	96.84	152.04	243.52	96.78	152.04	243.62	96.72	152.03
243.72	96.65	152.04	243.82	96.59	152.05	243.92	96.53	152.05
244.02	96.47	152.09	244.12	96.40	152.12	244.22	96.34	152.12
244.32	96.28	152.14	244.42	96.22	152.19	244.52	96.15	152.24
244.62	96.09	152.28	244.72	96.03	152.28	244.82	95.96	152.23
244.92	95.90	152.17	245.02	95.84	152.17	245.12	95.77	152.26

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
245.22	95.71	152.26	245.32	95.65	152.19	245.42	95.58	152.18
245.52	95.52	152.32	245.62	95.46	152.42	245.72	95.39	152.32
245.82	95.33	152.27	245.92	95.26	152.35	246.02	95.20	152.40
246.12	95.13	152.38	246.22	95.07	152.43	246.32	95.01	152.43
246.42	94.94	152.38	246.52	94.88	152.39	246.62	94.81	152.39
246.72	94.75	152.47	246.82	94.68	152.47	246.92	94.62	152.42
247.02	94.55	152.48	247.12	94.49	152.47	247.22	94.42	152.38
247.32	94.35	152.33	247.42	94.29	152.33	247.52	94.22	152.43
247.62	94.16	152.42	247.72	94.09	152.34	247.82	94.03	152.30
247.92	93.96	152.35	248.02	93.89	152.35	248.12	93.83	152.35
248.22	93.76	152.39	248.32	93.70	152.25	248.42	93.63	152.21
248.52	93.56	152.34	248.62	93.50	152.34	248.72	93.43	152.22
248.82	93.36	152.17	248.92	93.30	152.26	249.02	93.23	152.21
249.12	93.16	152.17	249.22	93.09	152.14	249.32	93.03	152.05
249.42	92.96	152.09	249.52	92.89	152.05	249.62	92.82	151.96
249.72	92.75	151.96	249.82	92.69	151.88	249.92	92.62	151.73
250.02	92.55	151.76	250.12	92.48	151.86	250.22	92.42	151.92
250.32	92.35	151.90	250.42	92.28	151.90	250.52	92.21	151.82
250.62	92.14	151.79	250.72	92.07	151.70	250.82	92.01	151.65
250.92	91.94	151.61	251.02	91.87	151.57	251.12	91.80	151.46
251.22	91.73	151.36	251.32	91.66	151.29	251.42	91.59	151.30
251.52	91.52	151.34	251.62	91.45	151.26	251.72	91.38	151.21
251.82	91.31	151.10	251.92	91.24	151.04	252.02	91.17	150.97
252.12	91.10	150.99	252.22	91.03	151.03	252.32	90.96	150.75
252.42	90.89	150.60	252.52	90.82	150.66	252.62	90.75	150.68
252.72	90.68	150.68	252.82	90.61	150.63	252.92	90.54	150.50
253.02	90.47	150.41	253.12	90.40	150.39	253.22	90.33	150.39
253.32	90.26	150.32	253.42	90.19	150.27	253.52	90.12	150.22
253.62	90.05	150.05	253.72	89.97	149.91	253.82	89.90	149.91
253.92	89.83	149.86	254.02	89.76	149.82	254.12	89.69	149.73
254.22	89.62	149.56	254.32	89.54	149.49	254.42	89.47	149.52
254.52	89.40	149.39	254.62	89.33	149.32	254.72	89.26	149.28
254.82	89.18	149.18	254.92	89.11	149.09	255.02	89.04	148.87
255.12	88.97	148.81	255.22	88.89	148.82	255.32	88.82	148.73
255.42	88.75	148.78	255.52	88.67	148.78	255.62	88.60	148.60
255.72	88.53	148.46	255.82	88.45	148.46	255.92	88.38	148.31
256.02	88.31	148.23	256.12	88.23	148.14	256.22	88.16	148.10
256.32	88.09	148.08	256.42	88.01	147.93	256.52	87.94	147.81
256.63	87.86	147.78	256.72	87.79	147.66	256.82	87.72	147.53
256.92	87.64	147.45	257.02	87.57	147.40	257.12	87.49	147.40
257.22	87.42	147.22	257.33	87.34	147.22	257.42	87.27	147.08
257.52	87.19	146.98	257.62	87.12	146.94	257.73	87.04	146.90
257.82	86.97	146.80	257.92	86.89	146.75	258.03	86.82	146.66
258.13	86.74	146.55	258.23	86.67	146.46	258.33	86.59	146.33
258.43	86.52	146.29	258.53	86.44	146.20	258.63	86.36	146.10
258.73	86.29	146.10	258.83	86.21	146.05	258.93	86.14	145.96
259.03	86.06	145.68	259.13	85.98	145.53	259.23	85.91	145.58
259.33	85.83	145.48	259.43	85.76	145.38	259.53	85.68	145.27
259.63	85.60	145.13	259.73	85.52	145.11	259.83	85.45	145.00
259.93	85.37	144.99	260.03	85.29	144.91	260.13	85.22	144.77

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
260.23	85.14	144.53	260.33	85.06	144.34	260.43	84.98	144.36
260.53	84.91	144.32	260.63	84.83	144.15	260.73	84.75	144.04
260.83	84.67	143.89	260.93	84.59	143.80	261.03	84.52	143.71
261.13	84.44	143.57	261.23	84.36	143.42	261.33	84.28	143.33
261.43	84.20	143.22	261.53	84.12	143.03	261.63	84.05	142.89
261.73	83.97	142.78	261.83	83.89	142.68	261.93	83.81	142.60
262.03	83.73	142.34	262.13	83.65	142.19	262.23	83.57	142.14
262.33	83.49	141.95	262.43	83.41	141.70	262.53	83.33	141.53
262.63	83.25	141.53	262.73	83.18	141.51	262.83	83.10	141.16
262.93	83.02	140.95	263.03	82.94	140.80	263.13	82.86	140.65
263.23	82.78	140.49	263.33	82.70	140.39	263.43	82.61	140.39
263.53	82.53	140.18	263.63	82.45	139.98	263.73	82.37	139.83
263.83	82.29	139.61	263.93	82.21	139.40	264.03	82.13	139.19
264.13	82.05	138.97	264.23	81.97	138.80	264.33	81.89	138.64
264.43	81.81	138.44	264.53	81.73	138.06	264.63	81.64	137.86
264.73	81.56	137.80	264.83	81.48	137.59	264.93	81.40	137.20
265.03	81.32	136.87	265.13	81.24	136.72	265.23	81.15	136.63
265.33	81.07	136.36	265.43	80.99	136.14	265.53	80.91	135.86
265.63	80.83	135.54	265.73	80.74	135.26	265.83	80.66	135.05
265.93	80.58	134.76	266.03	80.50	134.59	266.13	80.41	134.35
266.23	80.33	134.03	266.33	80.25	133.63	266.43	80.16	133.36
266.53	80.08	133.12	266.63	80.00	132.96	266.73	79.91	132.58
266.83	79.83	132.13	266.93	79.75	131.85	267.03	79.66	131.62
267.13	79.58	131.31	267.23	79.50	131.08	267.33	79.41	130.70
267.43	79.33	130.30	267.53	79.24	129.93	267.63	79.16	129.67
267.73	79.07	129.34	267.83	78.99	129.13	267.93	78.91	128.80
268.03	78.82	128.45	268.13	78.74	127.97	268.23	78.65	127.60
268.33	78.57	127.35	268.43	78.48	127.18	268.53	78.40	126.69
268.63	78.31	126.31	268.73	78.23	126.02	268.83	78.14	125.82
268.93	78.06	125.82	269.03	77.97	125.52	269.13	77.89	125.22
269.23	77.80	124.86	269.33	77.71	124.59	269.43	77.63	123.97
269.53	77.54	123.85	269.63	77.46	123.72	269.73	77.37	123.60
269.83	77.28	123.29	269.93	77.20	123.03	270.03	77.11	122.80
270.13	77.03	122.80	270.23	76.94	122.56	270.33	76.85	122.25
270.43	76.77	122.08	270.53	76.68	122.20	270.63	76.59	122.02
270.73	76.50	121.88	270.83	76.42	121.73	270.93	76.33	121.72
271.03	76.24	121.57	271.13	76.15	121.60	271.23	76.07	121.56
271.33	75.98	121.76	271.43	75.89	121.86	271.53	75.80	122.07
271.63	75.72	122.26	271.73	75.63	122.46	271.83	75.54	122.56
271.93	75.45	122.81	272.03	75.36	122.90	272.13	75.28	123.23
272.23	75.19	123.56	272.33	75.10	123.98	272.43	75.01	124.37
272.53	74.92	124.88	272.63	74.83	125.52	272.74	74.74	125.89
272.83	74.66	126.27	272.93	74.57	126.93	273.03	74.48	127.44
273.14	74.39	127.96	273.23	74.30	128.46	273.33	74.21	128.99
273.43	74.12	129.67	273.53	74.03	130.39	273.63	73.94	130.95
273.73	73.85	131.60	273.84	73.76	132.36	273.93	73.67	132.36
274.03	73.58	133.06	274.13	73.49	133.75	274.24	73.40	134.22
274.34	73.31	134.74	274.44	73.22	135.47	274.54	73.13	136.01
274.64	73.04	136.47	274.74	72.95	137.05	274.84	72.86	137.59
274.94	72.77	138.05	275.04	72.68	138.51	275.14	72.58	138.91

TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
275.24	72.49	139.10	275.34	72.40	139.22	275.44	72.31	139.51
275.54	72.22	139.79	275.64	72.13	139.92	275.74	72.04	139.92
275.84	71.94	139.30	275.94	71.85	139.89	276.04	71.76	139.83
276.14	71.67	139.69	276.24	71.58	139.53	276.34	71.48	139.31
276.44	71.39	139.03	276.54	71.30	138.69	276.64	71.21	138.43
276.74	71.11	138.16	276.84	71.02	137.73	276.94	70.93	137.27
277.04	70.84	136.77	277.14	70.74	136.36	277.24	70.65	135.96
277.34	70.56	135.54	277.44	70.46	135.18	277.54	70.37	134.82
277.64	70.28	134.36	277.74	70.18	133.87	277.84	70.09	133.56
277.94	70.00	133.12	278.04	69.90	132.59	278.14	69.81	132.27
278.24	69.71	132.00	278.34	69.62	131.49	278.44	69.53	131.27
278.54	69.43	131.28	278.64	69.34	130.94	278.74	69.24	130.54
278.84	69.15	130.44	278.94	69.05	130.42	279.04	68.96	130.25
279.14	68.86	130.28	279.24	68.77	130.28	279.34	68.67	130.29
279.44	68.58	130.13	279.54	68.48	130.19	279.64	68.39	130.36
279.74	68.29	130.47	279.84	68.20	130.72	279.94	68.10	130.94
280.04	68.01	131.21	280.14	67.91	131.43	280.24	67.82	131.60
280.34	67.72	132.13	280.44	67.63	132.63	280.54	67.53	132.97
280.64	67.43	133.48	280.74	67.34	134.13	280.84	67.24	134.51
280.94	67.14	135.08	281.04	67.05	135.80	281.14	66.95	136.32
281.24	66.85	137.07	281.34	66.76	137.62	281.44	66.66	138.21
281.54	66.56	138.94	281.64	66.47	139.61	281.74	66.37	140.10
281.84	66.27	140.63	281.94	66.17	141.20	282.04	66.08	141.68
282.14	65.98	141.96	282.24	65.88	142.20	282.34	65.78	142.49
282.44	65.69	142.62	282.54	65.59	142.62	282.64	65.49	142.59
282.74	65.39	142.49	282.84	65.29	142.49	282.94	65.20	141.82
283.04	65.10	141.82	283.14	65.00	141.34	283.24	64.90	140.77
283.34	64.80	140.28	283.44	64.70	139.85	283.54	64.60	139.34
283.64	64.51	138.76	283.74	64.41	138.15	283.84	64.31	137.51
283.94	64.21	136.86	284.04	64.11	136.40	284.14	64.01	136.02
284.24	63.91	135.54	284.34	63.81	135.00	284.44	63.71	134.72
284.54	63.61	134.70	284.64	63.51	134.59	284.74	63.41	134.42
284.84	63.31	134.53	284.94	63.21	134.73	285.04	63.11	134.99
285.14	63.01	135.30	285.24	62.91	135.75	285.34	62.81	136.39
285.44	62.71	137.05	285.54	62.61	138.04	285.64	62.51	138.97
285.74	62.41	139.81	285.84	62.31	139.81	285.94	62.20	140.89
286.04	62.10	142.39	286.14	62.00	143.75	286.24	61.90	145.13
286.34	61.80	146.52	286.44	61.70	148.00	286.54	61.60	149.48
286.64	61.49	150.81	286.74	61.39	151.93	286.84	61.29	152.95
286.94	61.19	153.61	287.04	61.09	154.06	287.14	60.98	154.16
287.24	60.88	153.99	287.34	60.78	153.61	287.44	60.68	152.83
287.54	60.58	151.94	287.64	60.47	150.91	287.74	60.37	149.79
287.84	60.27	148.59	287.94	60.16	147.42	288.04	60.06	146.28
288.14	59.96	145.36	288.24	59.86	144.40	288.34	59.75	143.50
288.44	59.65	142.71	288.54	59.55	142.35	288.64	59.44	142.17
288.75	59.34	141.92	288.84	59.23	141.85	288.94	59.13	141.85
289.04	59.03	142.19	289.14	58.92	142.60	289.24	58.82	143.10
289.34	58.71	143.74	289.44	58.61	144.40	289.54	58.51	145.26
289.64	58.40	146.25	289.74	58.30	146.99	289.85	58.19	147.70
289.94	58.09	148.58	290.04	57.98	149.02	290.14	57.88	149.26

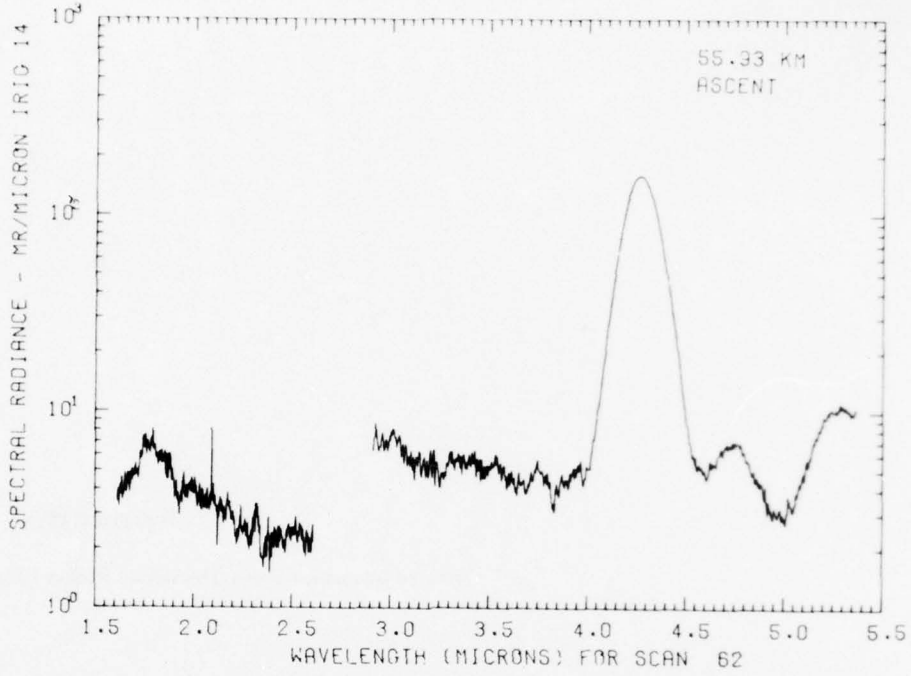
TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
290.25	57.77	149.39	290.35	57.67	149.24	290.45	57.56	148.76
290.55	57.46	148.10	290.65	57.35	147.30	290.75	57.25	146.31
290.85	57.14	145.43	290.95	57.03	144.57	291.05	56.93	143.89
291.15	56.82	143.27	291.25	56.72	143.27	291.35	56.61	142.72
291.45	56.51	142.51	291.55	56.40	142.70	291.65	56.29	143.17
291.75	56.19	143.72	291.85	56.08	119.37	291.95	55.97	120.41
292.05	55.87	146.92	292.15	55.76	148.42	292.25	55.65	150.19
292.35	55.55	151.99	292.45	55.44	153.83	292.55	55.33	155.37
292.65	55.22	156.57	292.75	55.12	157.44	292.85	55.01	157.92
292.95	54.90	157.70	293.05	54.80	157.08	293.15	54.69	156.07
293.25	54.58	154.73	293.35	54.47	153.43	293.45	54.36	153.43
293.55	54.26	151.93	293.65	54.15	150.73	293.75	54.04	149.65
293.85	53.93	148.78	293.95	53.82	148.35	294.05	53.71	148.26
294.15	53.61	148.37	294.25	53.50	148.80	294.35	53.39	149.61
294.45	53.28	150.43	294.55	53.17	151.47	294.65	53.06	152.52
294.75	52.95	153.19	294.85	52.84	153.63	294.95	52.73	153.82
295.05	52.62	153.52	295.15	52.51	152.79	295.25	52.40	151.87
295.35	52.29	151.87	295.45	52.19	150.85	295.55	52.08	149.81
295.65	51.97	148.77	295.75	51.86	148.08	295.85	51.75	147.78
295.95	51.64	147.83	296.05	51.52	148.41	296.15	51.41	149.41
296.25	51.30	150.82	296.35	51.19	152.52	296.45	51.08	154.60
296.55	50.97	156.65	296.65	50.86	158.48	296.75	50.75	159.78
296.85	50.64	160.71	296.95	50.53	160.95	297.05	50.42	160.24
297.15	50.30	160.24	297.25	50.19	158.98	297.35	50.08	157.47
297.45	49.97	155.87	297.55	49.86	154.40	297.65	49.75	153.40
297.75	49.63	152.62	297.85	49.52	152.54	297.95	49.41	153.03
298.05	49.30	153.70	298.15	49.19	154.71	298.25	49.07	155.66
298.35	48.95	156.50	298.45	48.85	156.94	298.55	48.74	156.71
298.65	48.62	156.02	298.75	48.51	154.92	298.85	48.40	154.92
298.95	48.28	153.53	299.05	48.17	151.96	299.15	48.06	150.91
299.25	47.94	150.34	299.35	47.83	150.25	299.45	47.72	150.94
299.55	47.60	152.25	299.65	47.49	154.17	299.75	47.38	156.42
299.85	47.26	159.07	299.95	47.15	161.29	300.05	47.03	162.81
300.15	46.92	163.37	300.25	46.81	162.91	300.35	46.69	161.59
300.45	46.58	151.59	300.55	46.46	159.74	300.65	46.35	158.08
300.75	46.23	156.80	300.85	46.12	156.18	300.95	46.00	156.21
301.05	45.89	156.91	301.15	45.77	158.06	301.25	45.66	159.18
301.35	45.54	160.05	301.45	45.43	160.14	301.55	45.31	159.42
301.65	45.20	158.16	301.75	45.08	156.50	301.85	44.97	154.94
301.95	44.85	153.76	302.05	44.73	153.76	302.15	44.62	153.38
302.25	44.50	153.89	302.35	44.39	155.26	302.45	44.27	157.42
302.55	44.15	159.81	302.65	44.04	162.35	302.75	43.92	164.19
302.85	43.80	164.89	302.95	43.69	164.45	303.05	43.57	163.17
303.15	43.45	161.77	303.25	43.34	160.55	303.35	43.22	159.95
303.45	43.10	160.33	303.55	42.99	161.29	303.65	42.87	162.38
303.75	42.75	162.38	303.85	42.63	163.11	303.95	42.52	162.94
304.05	42.40	161.75	304.15	42.28	159.80	304.25	42.16	157.78
304.35	42.04	156.08	304.45	41.93	120.52	304.55	41.81	120.88
304.65	41.69	157.09	304.75	41.57	159.41	304.86	41.45	161.78
304.95	41.33	163.79	305.05	41.22	164.78	305.15	41.10	164.57

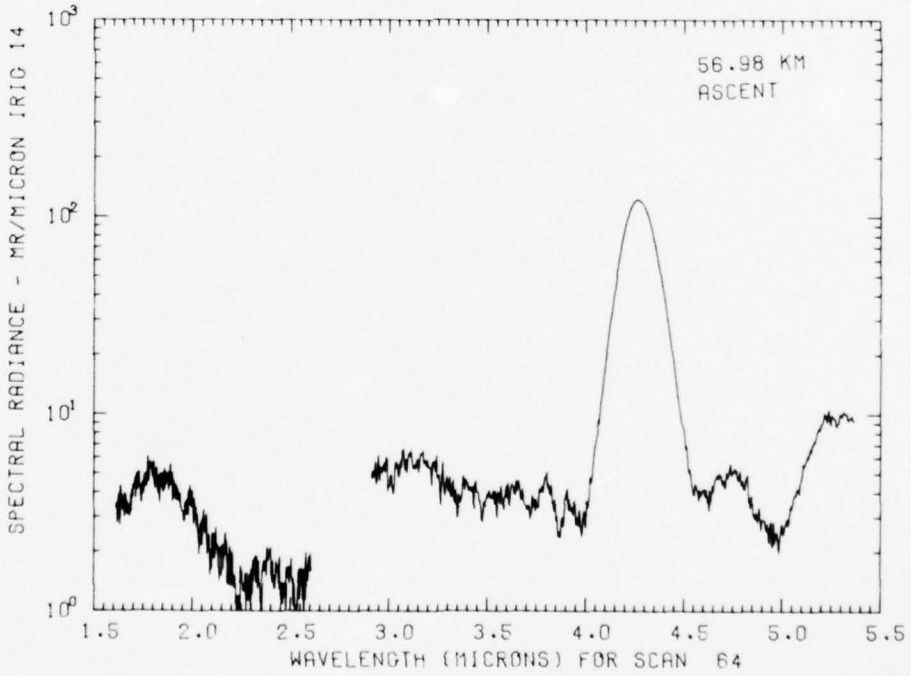
TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
305.26	40.98	163.70	305.35	40.86	162.74	305.45	40.74	162.74
305.55	40.62	162.34	305.65	40.50	162.78	305.75	40.38	163.75
305.85	40.26	164.71	305.96	40.14	165.15	306.05	40.02	164.57
306.16	39.90	162.98	306.26	39.78	160.98	306.36	39.66	159.34
306.46	39.54	158.48	306.56	39.42	158.85	306.66	39.30	160.34
306.76	39.18	162.38	306.86	39.06	164.53	306.96	38.94	165.80
307.06	38.82	165.85	307.16	38.70	165.14	307.26	38.58	164.43
307.36	38.46	164.43	307.46	38.34	165.17	307.56	38.22	166.27
307.66	38.10	166.27	307.76	37.98	167.12	307.86	37.86	166.85
307.96	37.73	165.18	308.06	37.61	163.09	308.16	37.49	161.42
308.26	37.37	160.78	308.36	37.25	161.49	308.46	37.13	163.08
308.56	37.00	164.94	308.66	36.88	166.20	308.76	36.76	166.49
308.86	36.64	166.25	308.96	36.52	166.09	309.06	36.39	166.56
309.16	36.27	167.86	309.26	36.15	168.98	309.36	36.03	169.02
309.46	35.90	167.70	309.56	35.78	165.38	309.66	35.66	163.38
309.76	35.53	162.43	309.86	35.41	163.06	309.96	35.29	164.79
310.06	35.17	166.29	310.16	35.04	167.14	310.26	34.92	167.13
310.36	34.80	166.80	310.46	34.67	167.12	310.56	34.55	168.49
310.66	34.42	170.21	310.76	34.30	170.77	310.86	34.18	169.52
310.96	34.05	167.10	311.06	33.93	165.14	311.16	33.80	164.57
311.26	33.68	165.32	311.36	33.55	166.84	311.46	33.43	167.98
311.56	33.31	168.13	311.66	33.18	167.97	311.76	33.06	168.45
311.86	32.93	169.98	311.96	32.81	171.81	312.06	32.68	172.23
312.16	32.56	170.72	312.26	32.43	168.35	312.36	32.31	166.74
312.46	32.18	166.59	312.56	32.05	167.40	312.66	31.93	168.33
312.76	31.80	168.61	312.86	31.68	168.58	312.96	31.55	169.21
313.06	31.42	170.80	313.16	31.30	172.67	313.26	31.17	171.71
313.36	31.05	169.54	313.46	30.92	168.18	313.56	30.79	168.22
313.66	30.67	169.03	313.76	30.54	169.41	313.86	30.41	169.16
313.96	30.29	169.44	314.06	30.16	170.92	314.16	30.03	173.01
314.26	29.90	173.95	314.36	29.78	172.75	314.46	29.65	170.73
314.56	29.52	169.60	314.66	29.40	169.77	314.76	29.27	170.20
314.86	29.14	170.08	314.96	29.01	169.96	315.06	28.89	170.87
315.16	28.75	174.43	315.26	28.63	174.04	315.36	28.50	172.08
315.46	28.37	170.64	315.56	28.24	170.49	315.66	28.12	170.72
315.76	27.99	170.56	315.86	27.86	170.48	315.96	27.73	171.63
316.06	27.60	173.79	316.16	27.47	175.28	316.26	27.34	172.77
316.36	27.21	171.94	316.46	27.09	171.86	316.56	26.96	171.51
316.66	26.83	171.19	316.76	26.70	171.85	316.86	26.57	173.73
316.96	26.44	173.91	317.06	26.31	173.91	317.16	26.18	172.70
317.26	26.05	172.44	317.36	25.92	172.17	317.46	25.79	171.98
317.56	25.66	172.81	317.66	25.53	174.62	317.76	25.40	175.55
317.86	25.27	174.27	317.96	25.14	173.62	318.06	25.01	173.23
318.16	24.88	172.64	318.26	24.74	172.80	318.36	24.61	174.34
318.46	24.48	176.32	318.56	24.35	175.30	318.66	24.22	174.38
318.76	24.09	173.69	318.86	23.96	172.99	318.96	23.83	174.60
319.06	23.69	176.58	319.16	23.56	176.08	319.26	23.43	176.08
319.36	23.30	174.19	319.46	23.17	173.34	319.56	23.04	173.62
319.66	22.90	174.59	319.75	22.77	174.59	319.86	22.64	174.59
319.96	22.51	174.59	320.06	22.37	174.51	320.16	22.24	174.01

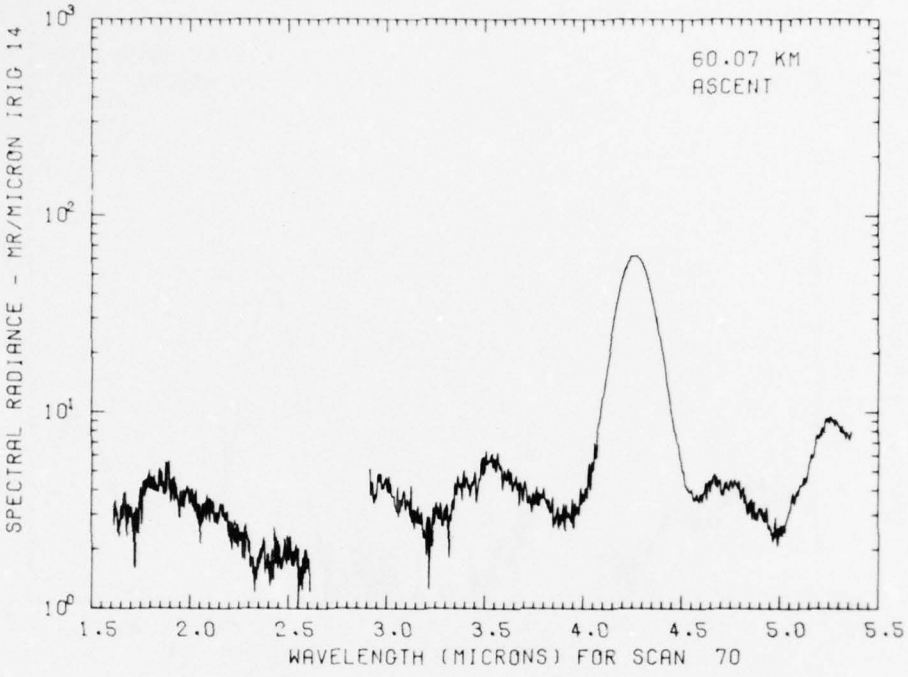
TIME	ALT	GAMMA	TIME	ALT	GAMMA	TIME	ALT	GAMMA
320.26	22.11	174.75	320.36	21.98	175.09	320.46	21.84	175.09
320.56	21.71	175.09	320.66	21.58	174.44	320.76	21.44	174.70
320.87	21.31	176.13	320.97	21.18	175.84	321.06	21.04	175.84
321.16	20.91	175.84	321.26	20.78	175.84	321.37	20.64	175.26
321.46	20.51	175.26	321.56	20.38	175.26	321.66	20.24	175.26
321.77	20.11	174.98	321.86	19.97	175.21	321.96	19.84	176.64
322.07	19.70	176.30	322.17	19.57	176.30	322.27	19.44	176.30
322.37	19.30	175.76	322.47	19.17	176.11	322.57	19.03	176.11
322.67	18.90	176.11	322.77	18.76	176.11	322.87	18.63	179.98
322.97	18.49	179.98	323.07	18.36	179.98	323.17	18.22	179.98
323.27	18.09	179.98	323.37	17.95	134.99	323.47	17.82	134.99
323.57	17.68	134.99	323.67	17.54	134.99	323.77	17.41	134.99
323.87	17.27	134.99	323.97	17.14	134.99	324.07	17.00	134.99
324.17	16.86	134.99	324.27	16.73	134.99	324.37	16.59	134.99
324.47	16.45	134.99	324.57	16.32	134.99			

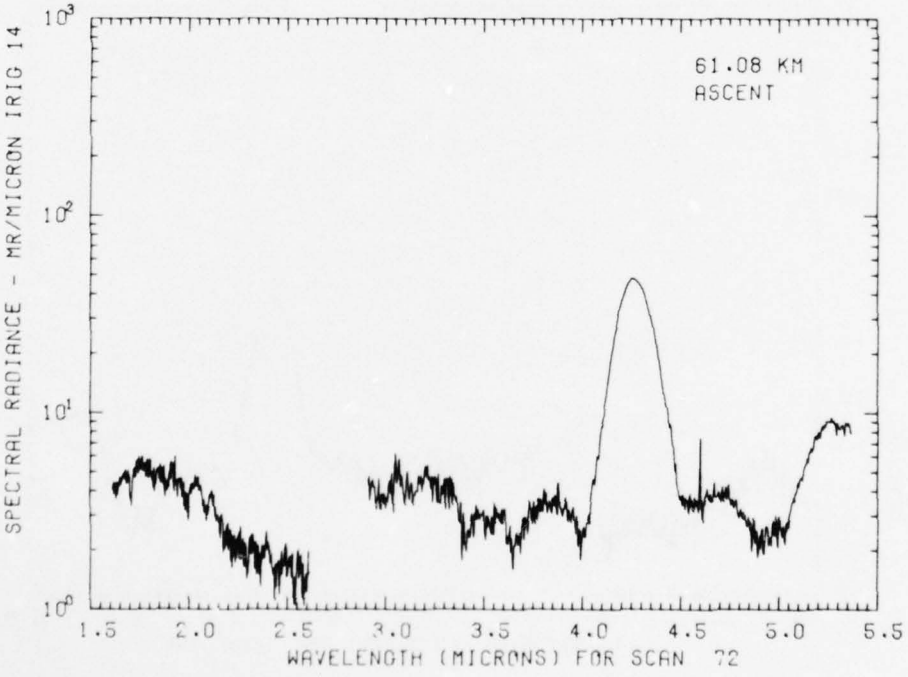
Appendix C

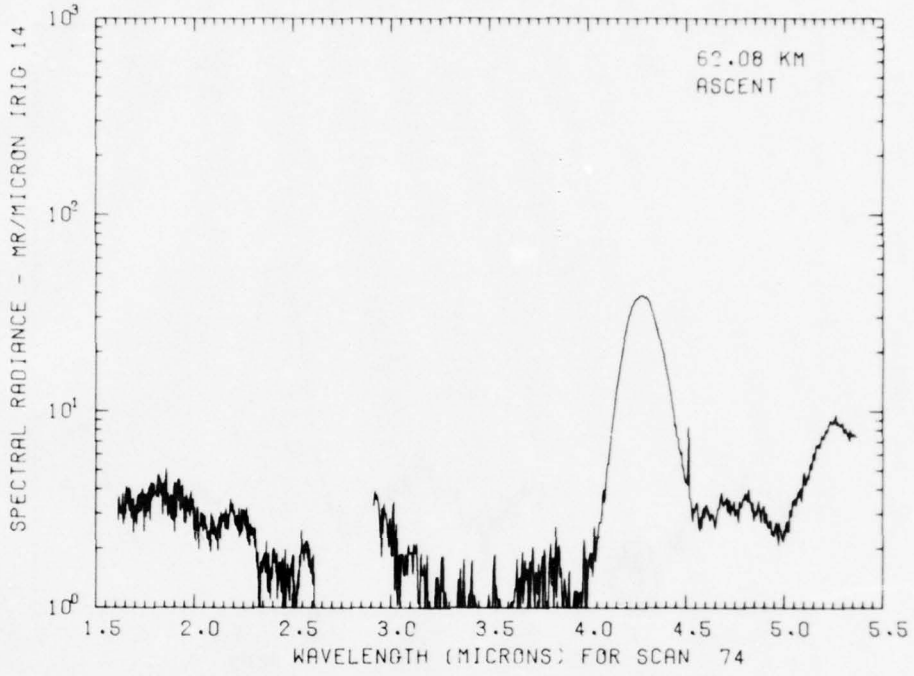
Selected Instrument Scans Throughout Rocket Flight

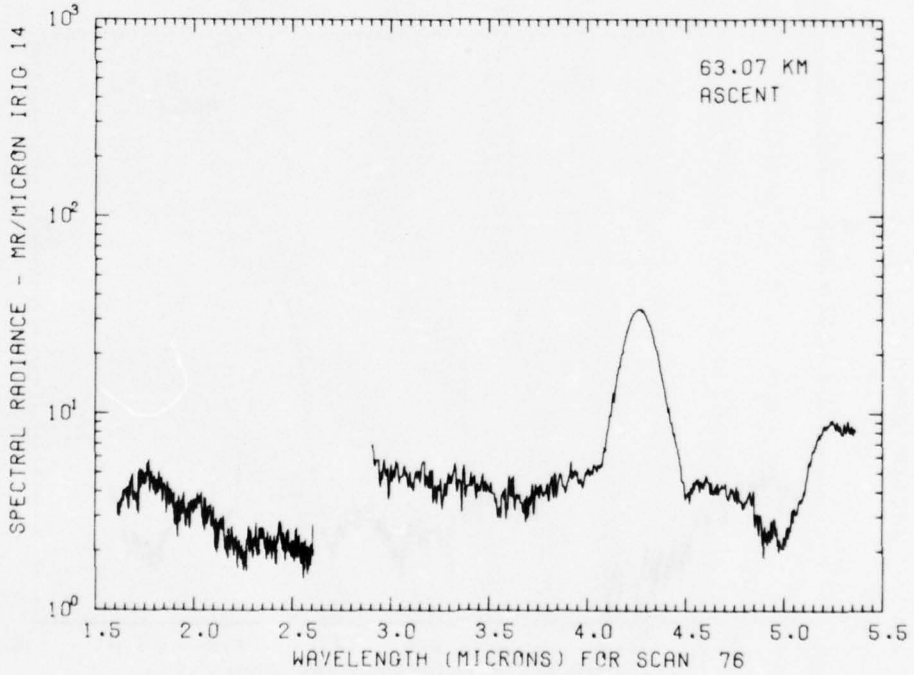

SPECTRAL RADIANCE - MR/MICRON IRIG 14
55.33 KM
ASCENT
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 62

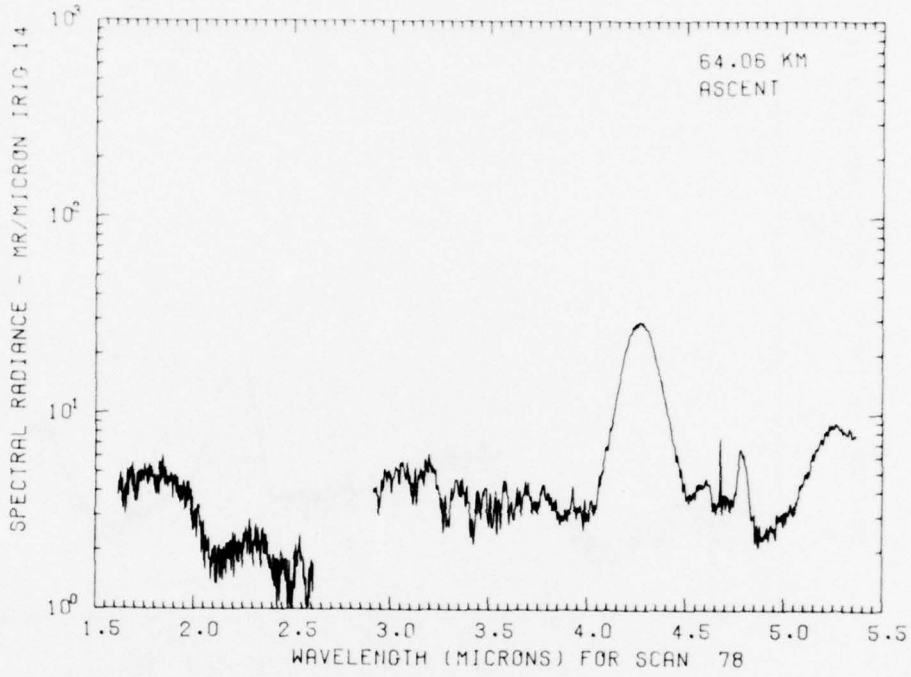

SPECTRAL RADIANCE - MR/MICRON IRIG 14
56.98 KM
ASCENT
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 64

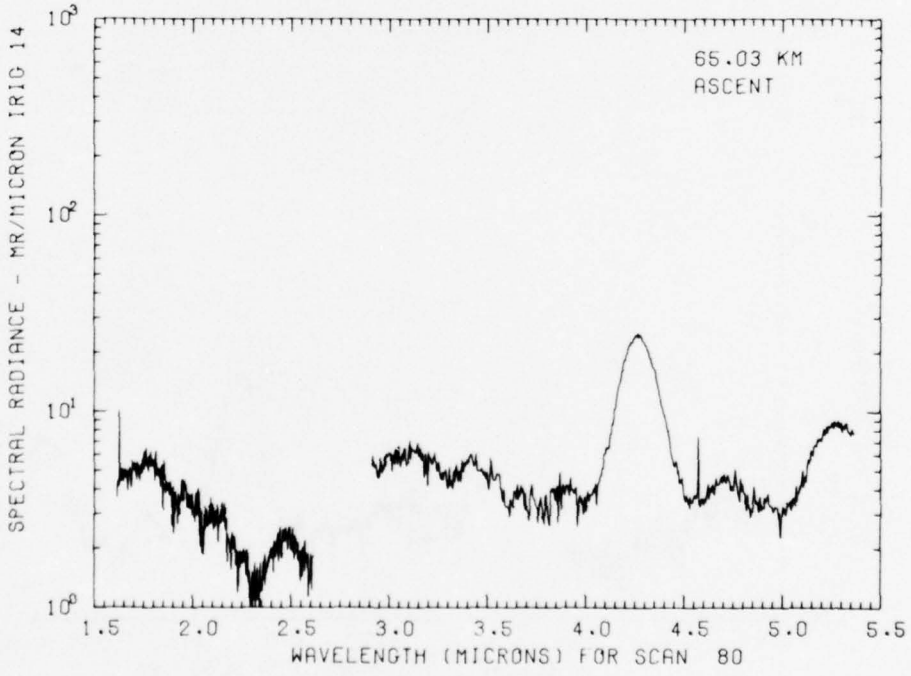

60.07 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 70

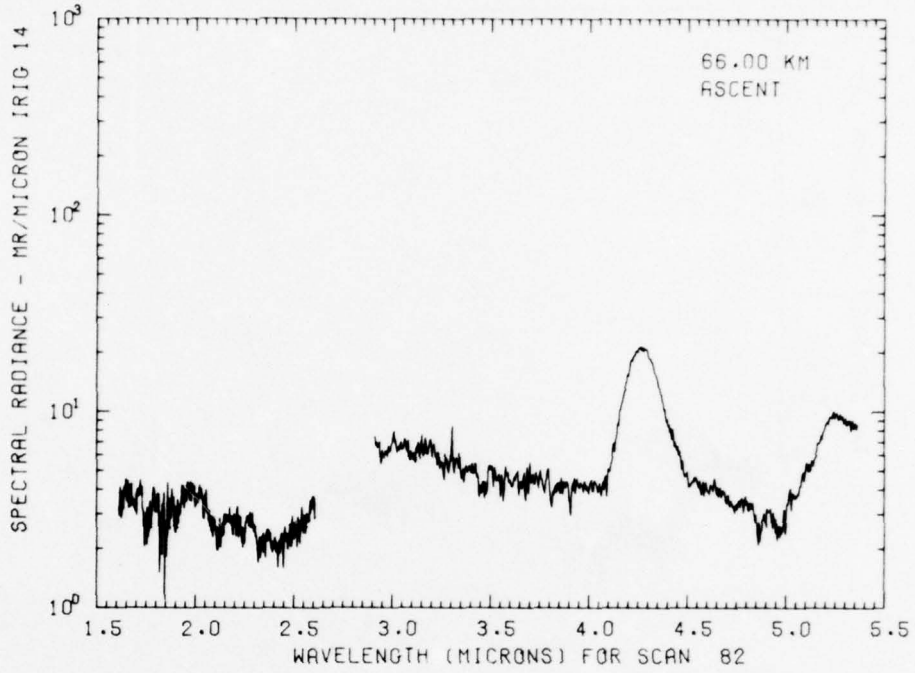

61.08 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 72

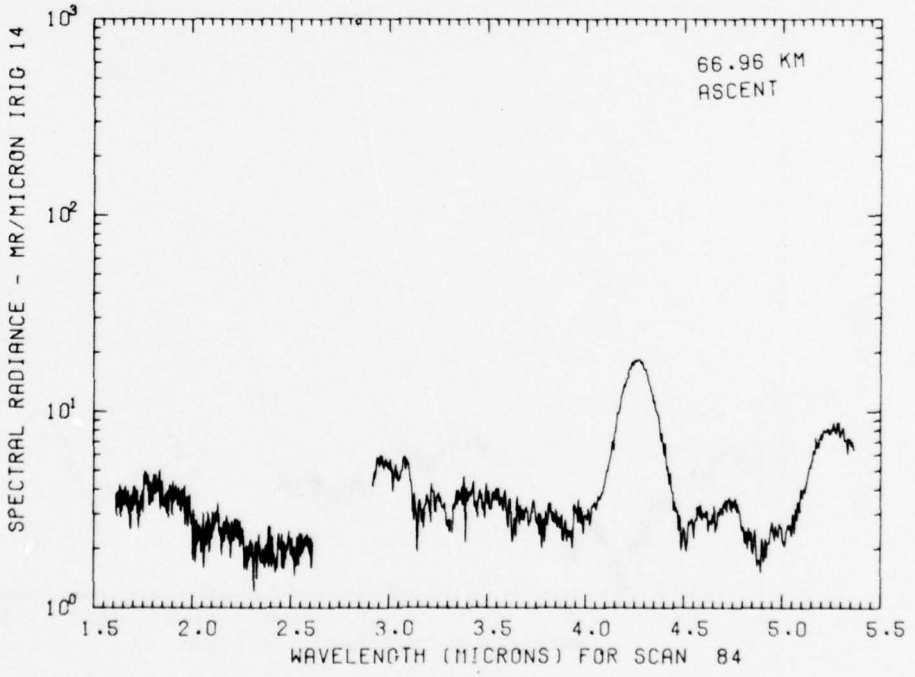

62.08 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 74

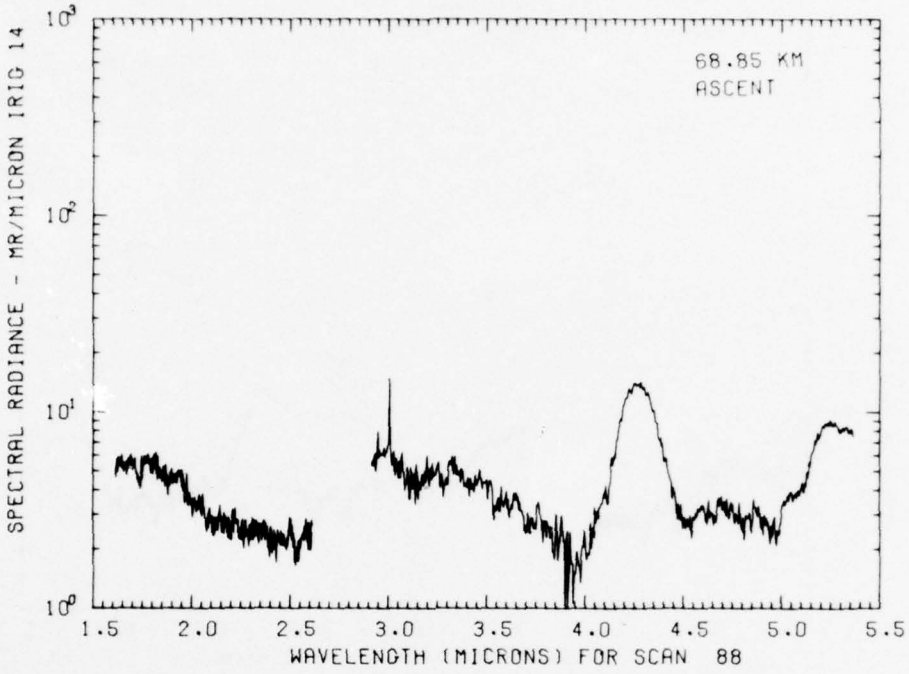

63.07 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 76

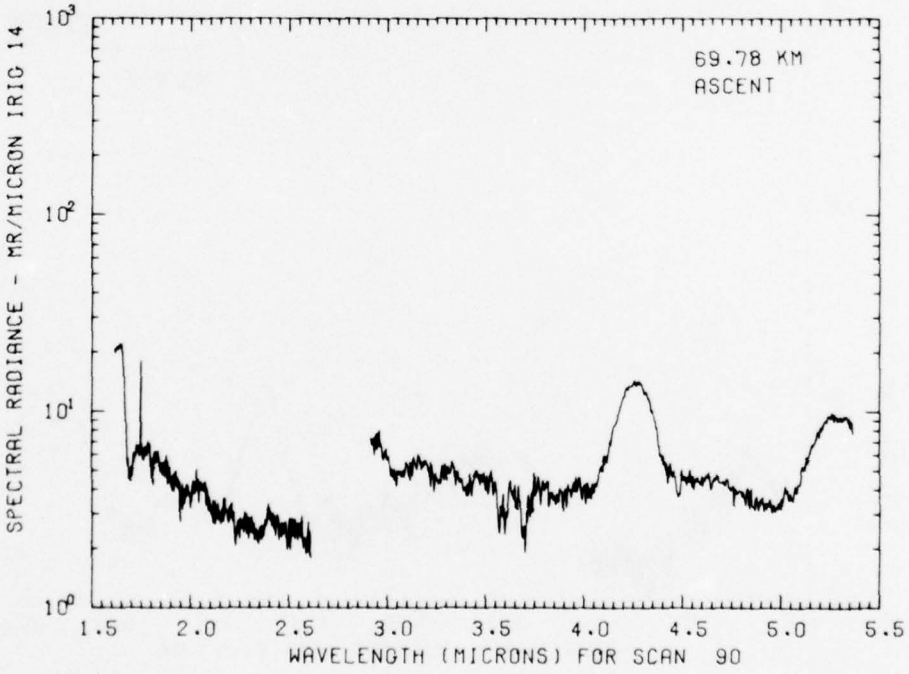

64.06 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
WAVELENGTH (MICRONS) FOR SCAN 78

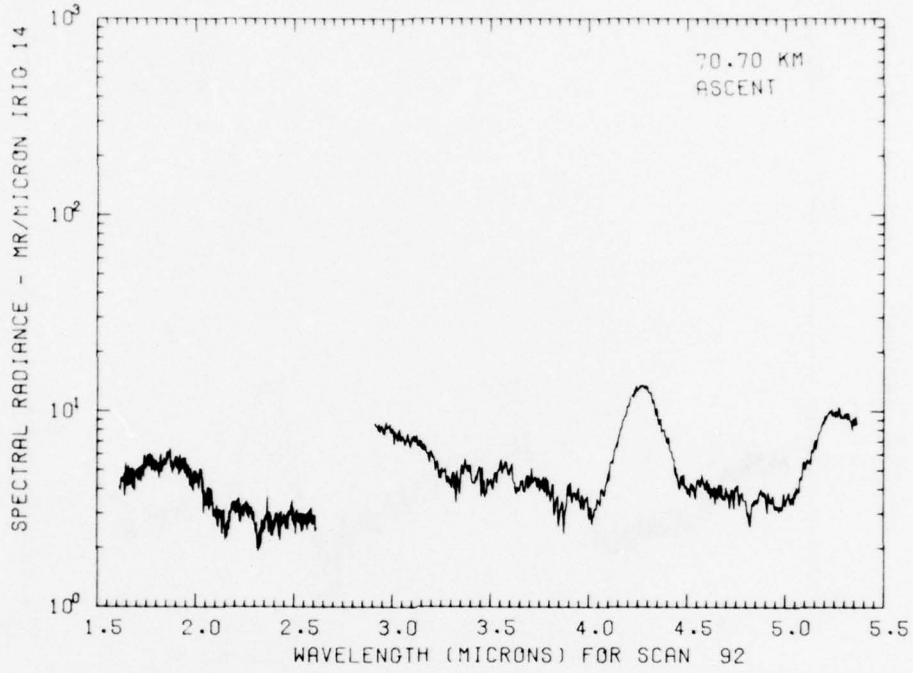

65.03 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
WAVELENGTH (MICRONS) FOR SCAN 80

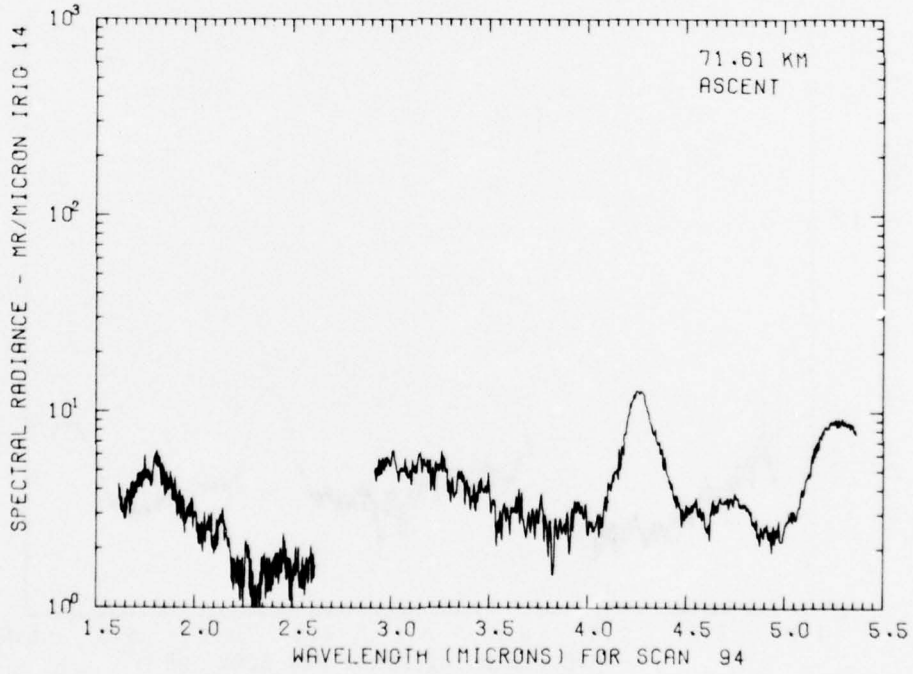

66.00 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 82

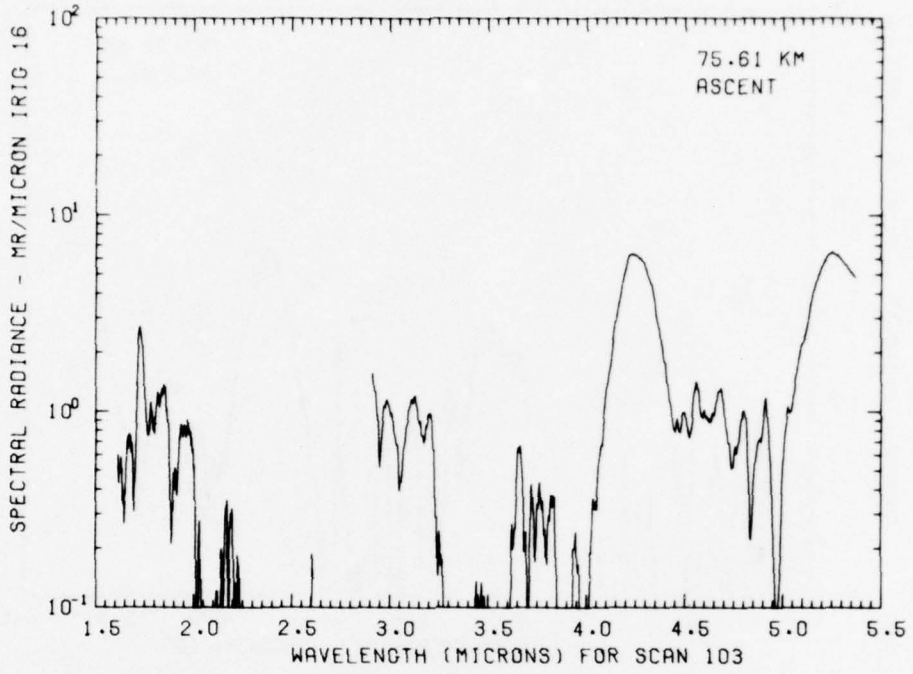

66.96 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 84

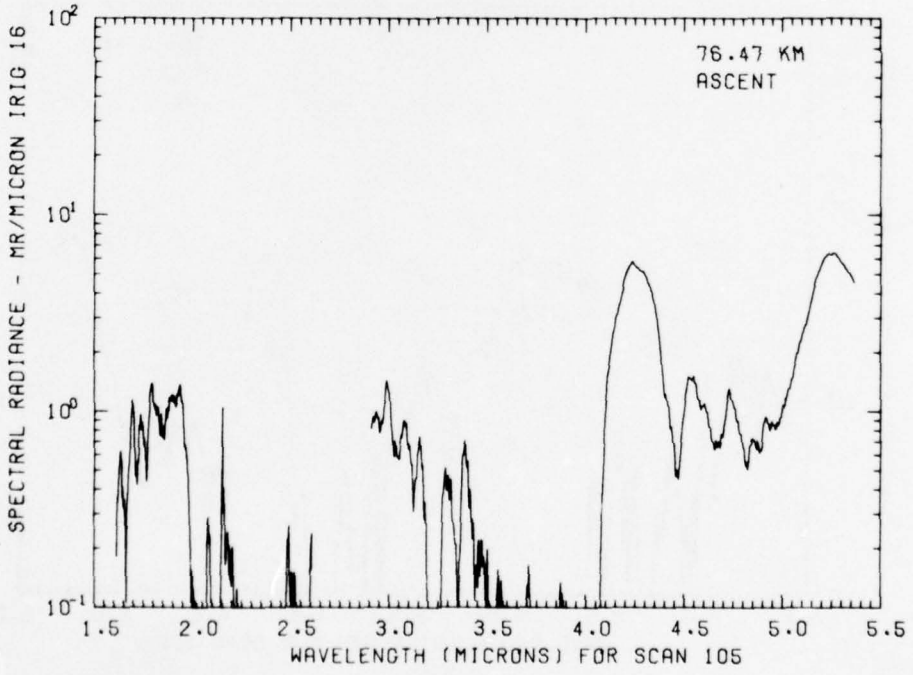

SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
68.85 KM
ASCENT
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 88

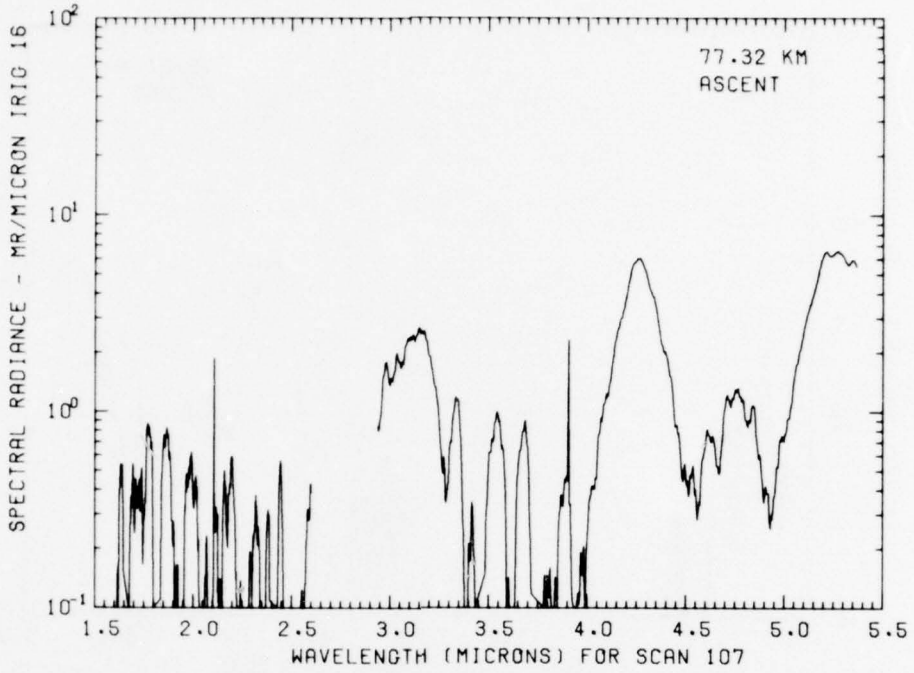

SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
69.78 KM
ASCENT
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 90

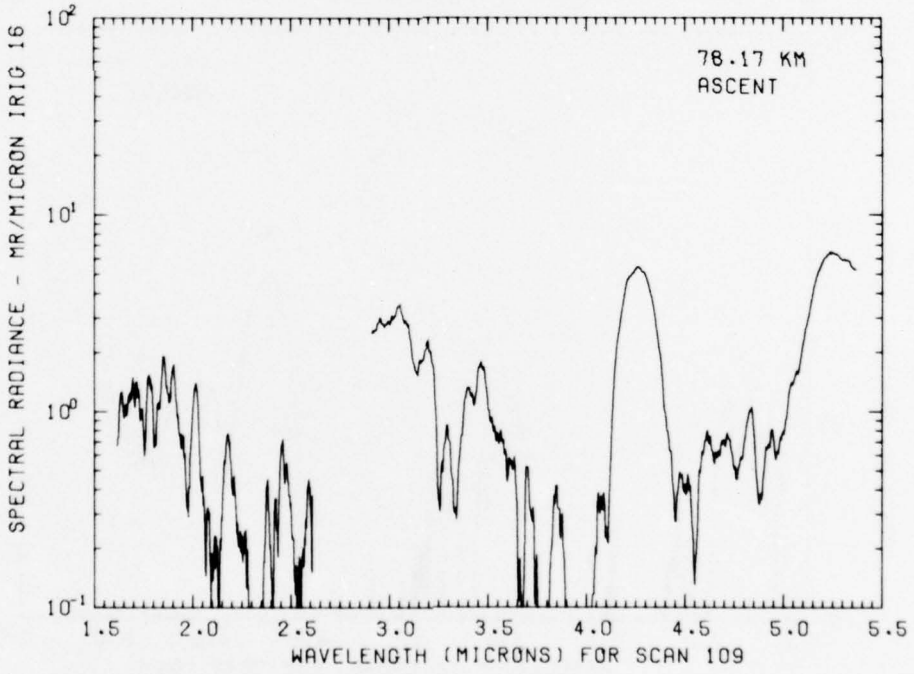

70.70 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 92

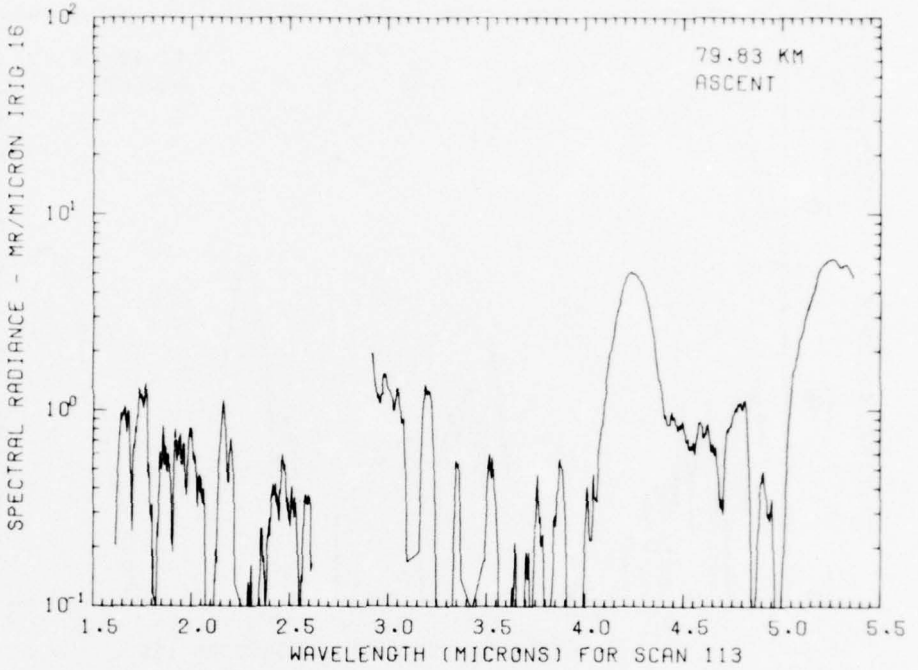

71.61 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 14
10^3
10^2
10^1
10^0
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 94

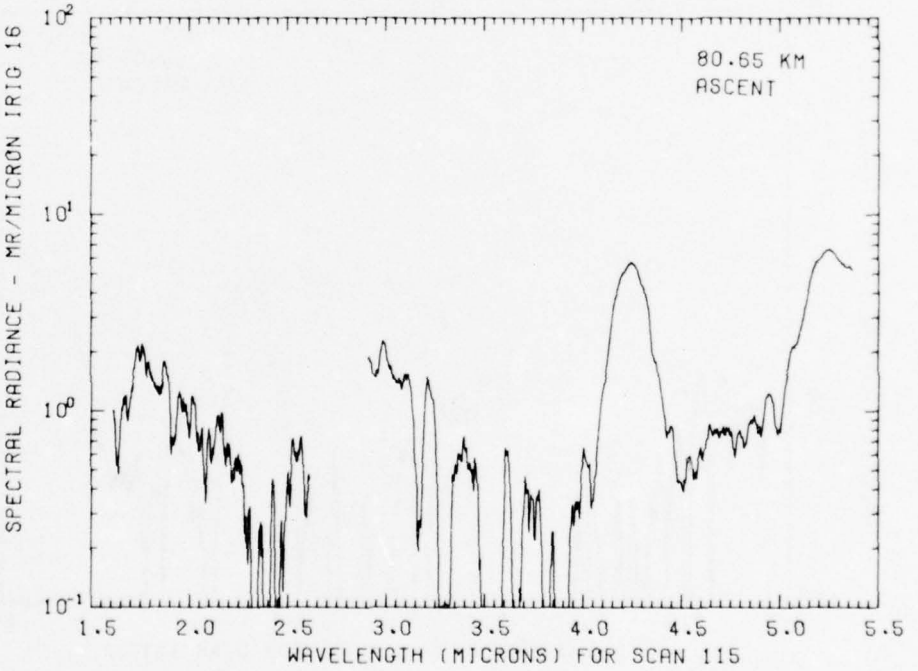

75.61 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 103

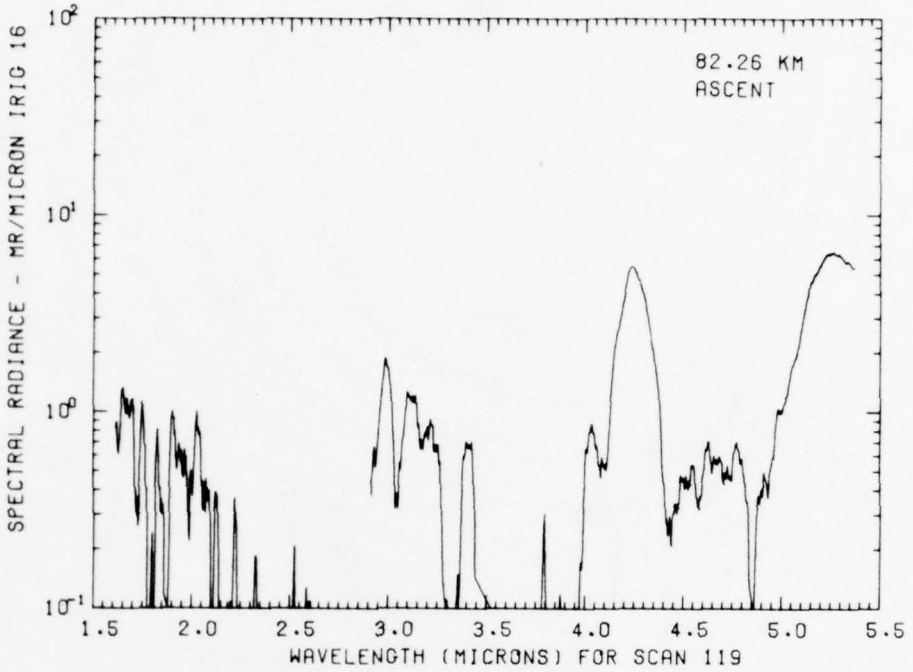

76.47 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 105

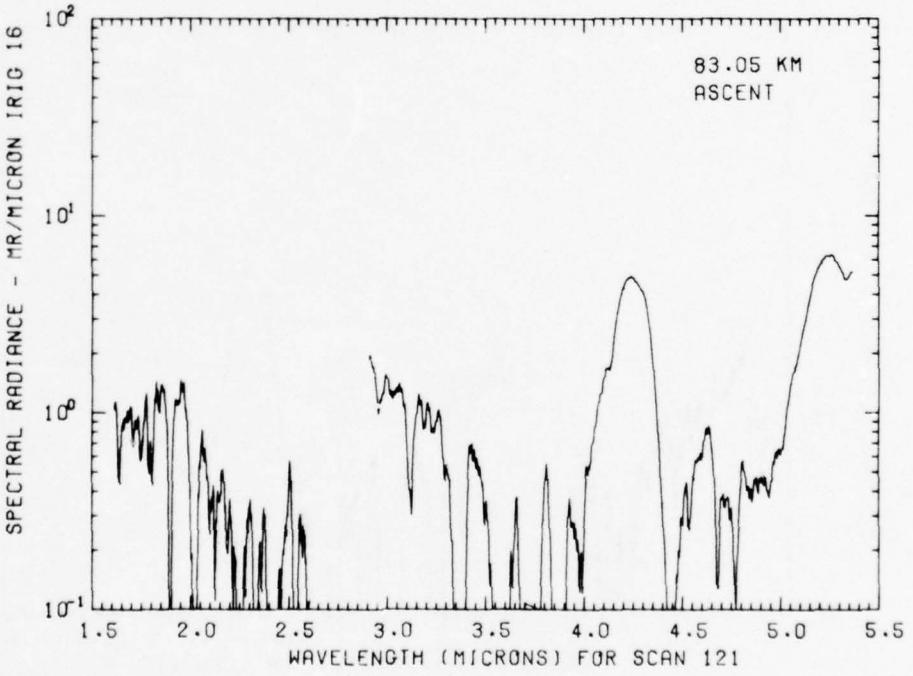

77.32 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 107

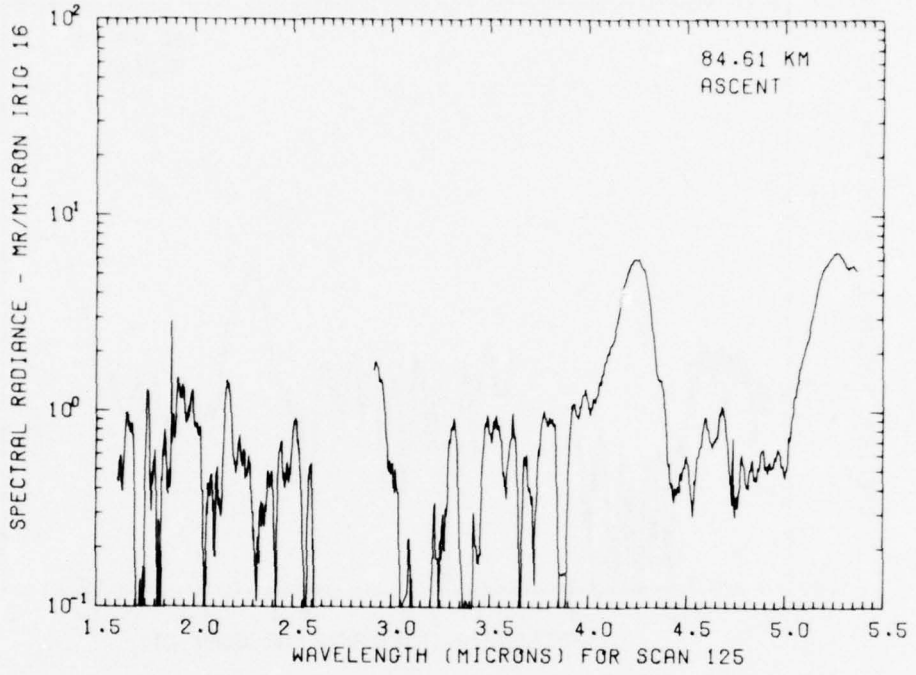

78.17 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 109

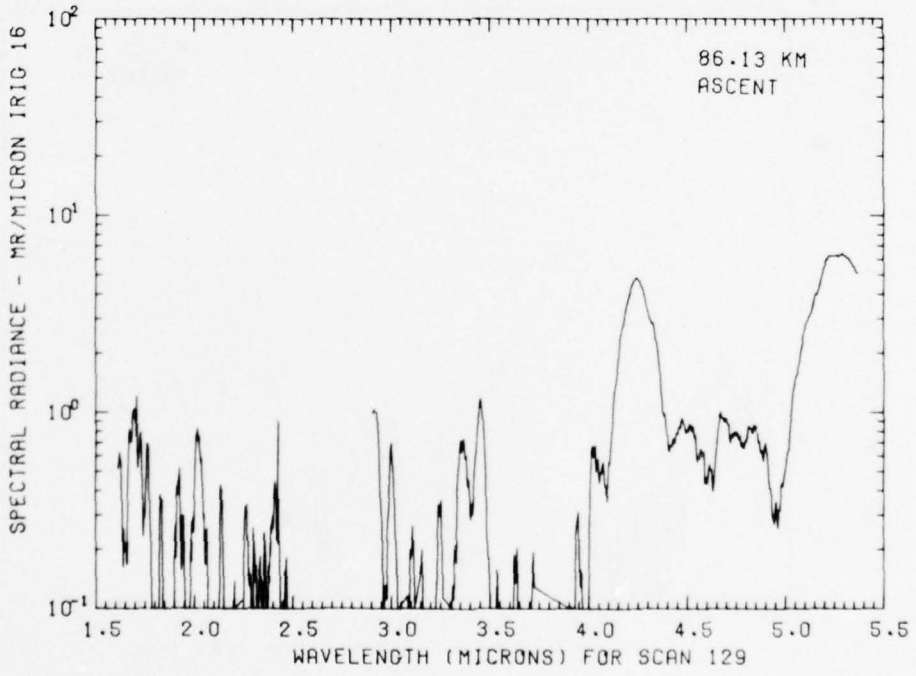

79.83 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 113

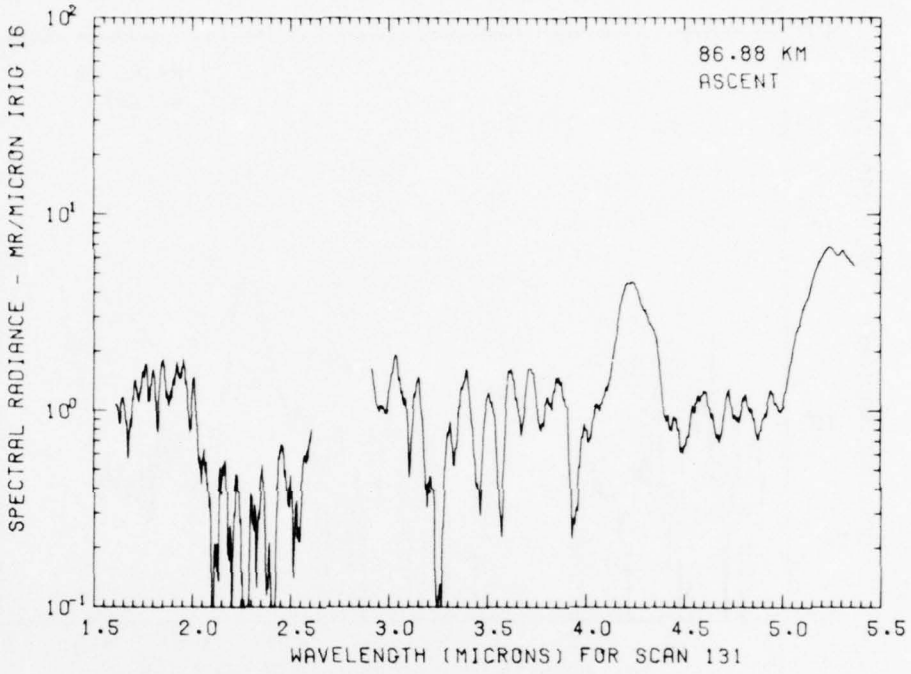

80.65 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 115

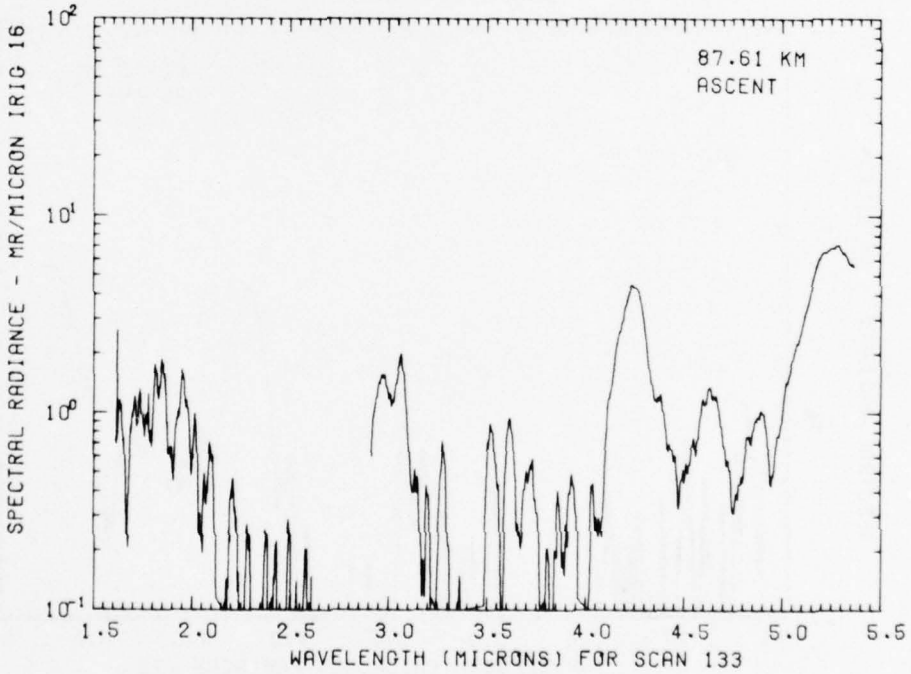

82.26 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 119

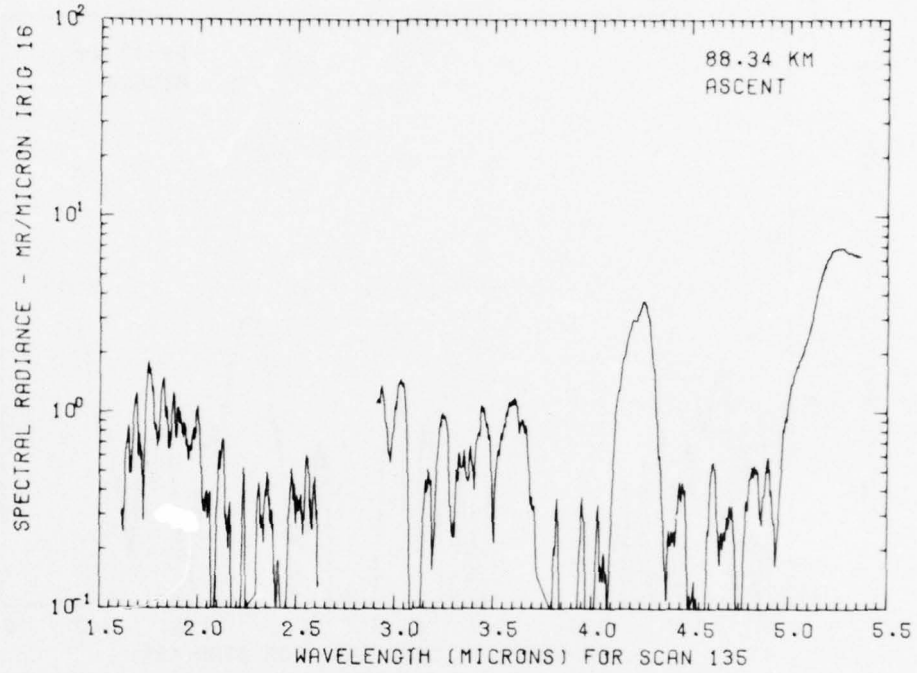

83.05 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 121

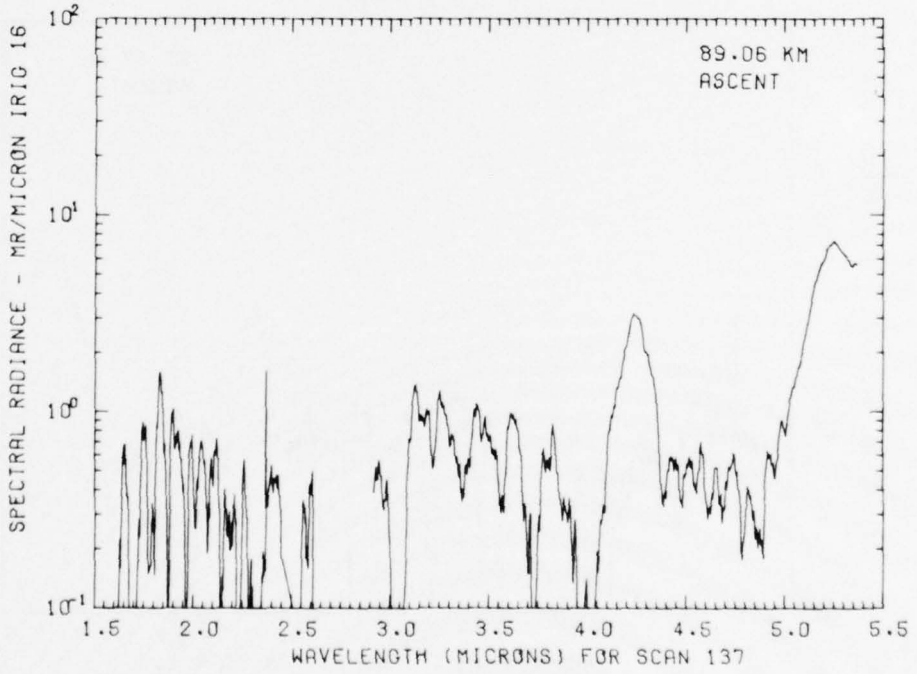

84.61 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 125

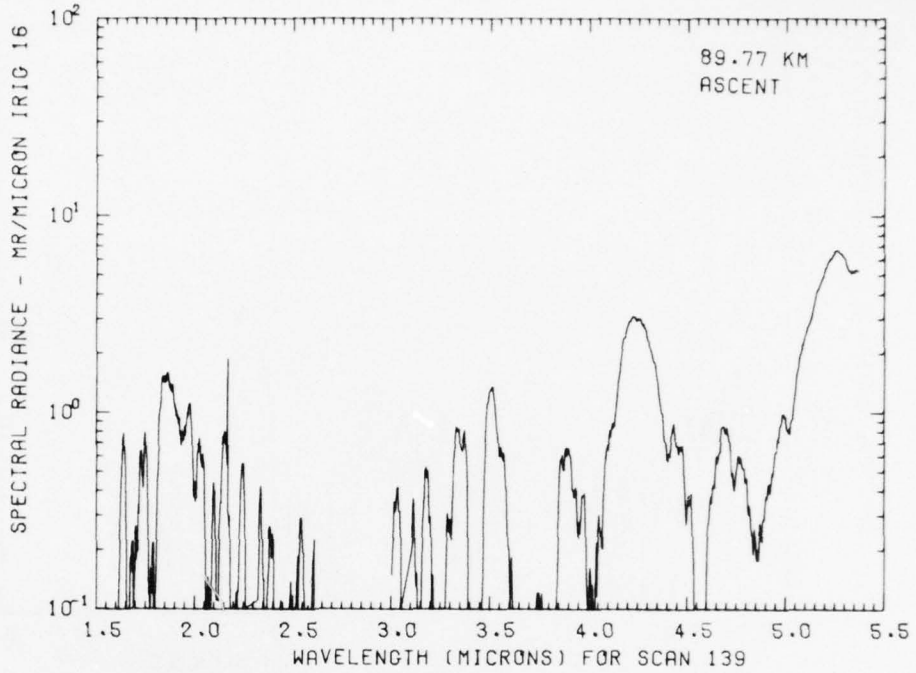

86.13 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 129

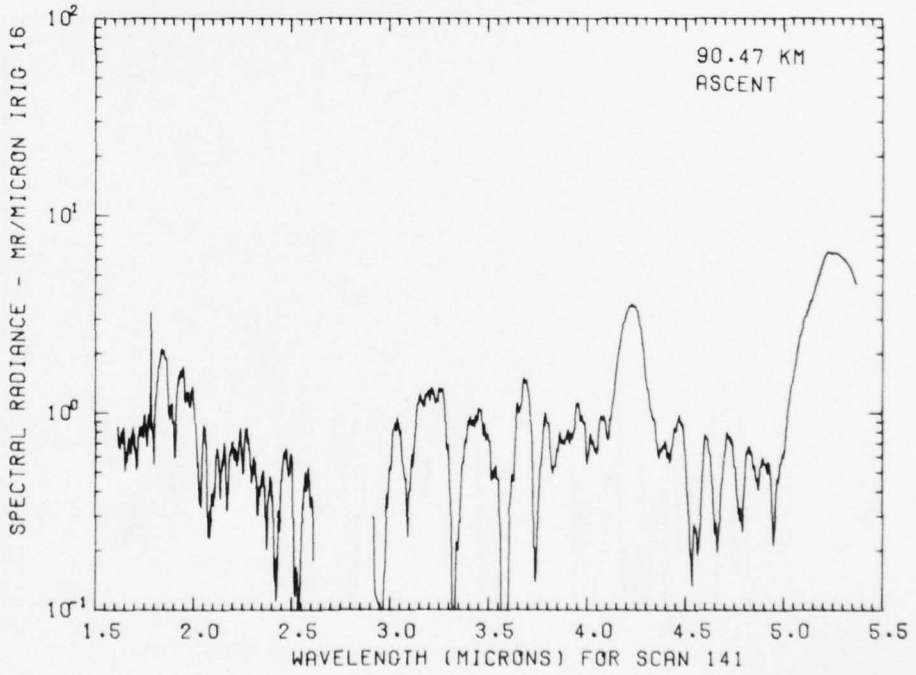

86.88 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 131

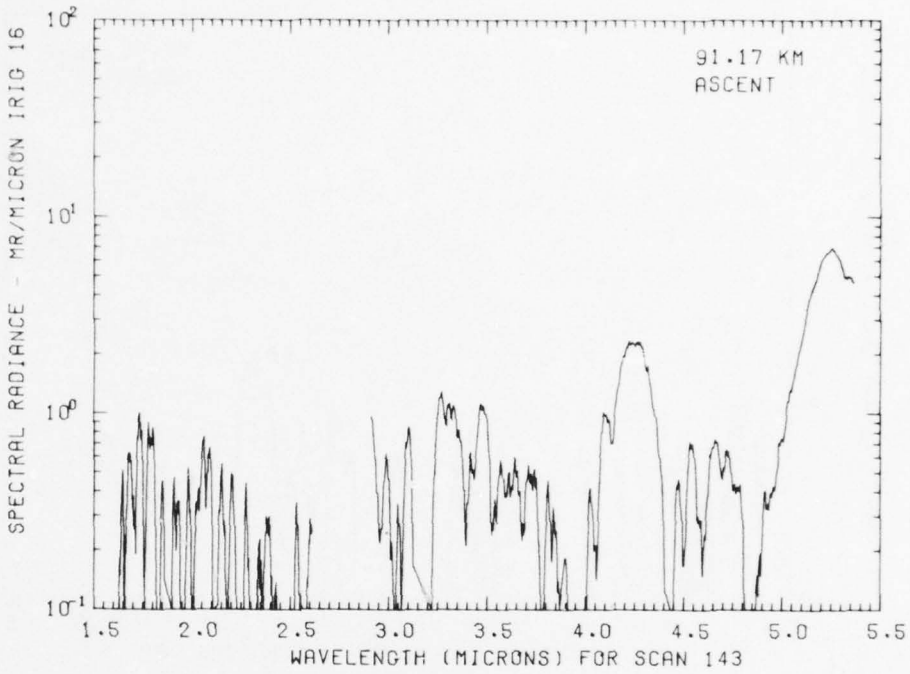

87.61 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 133

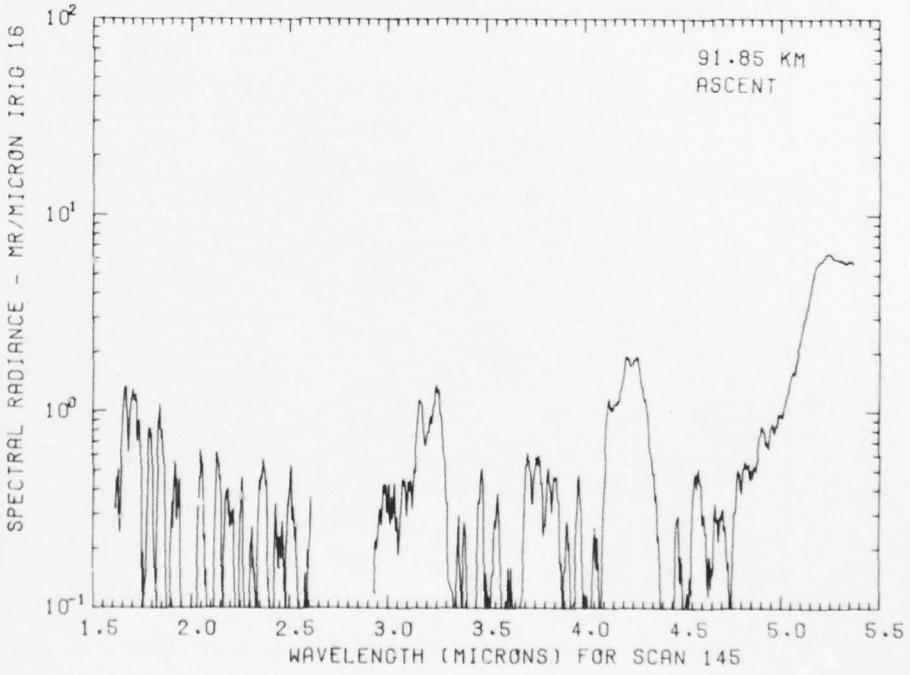

88.34 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 135

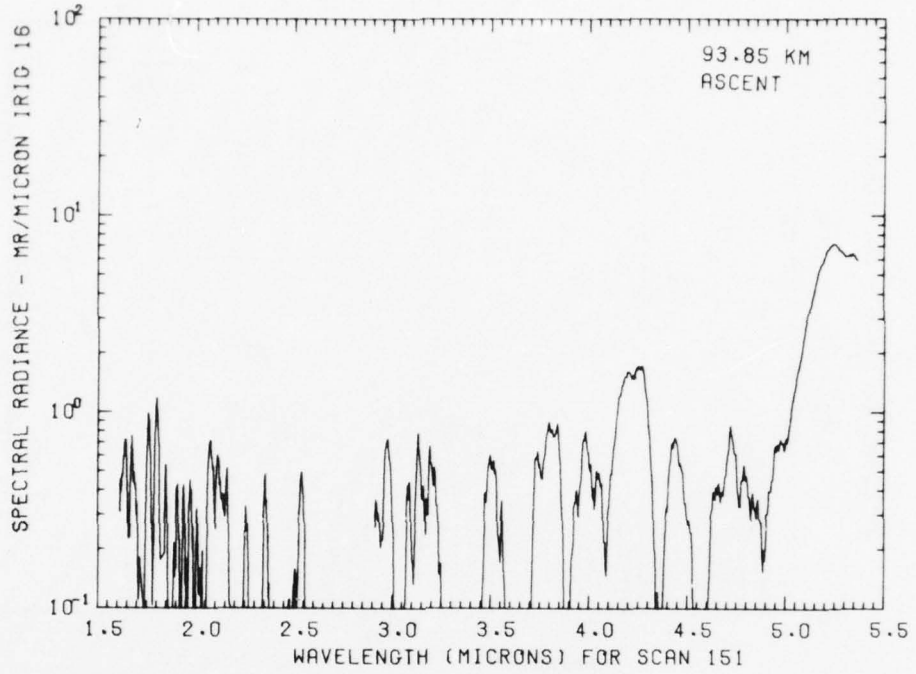

89.06 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 137

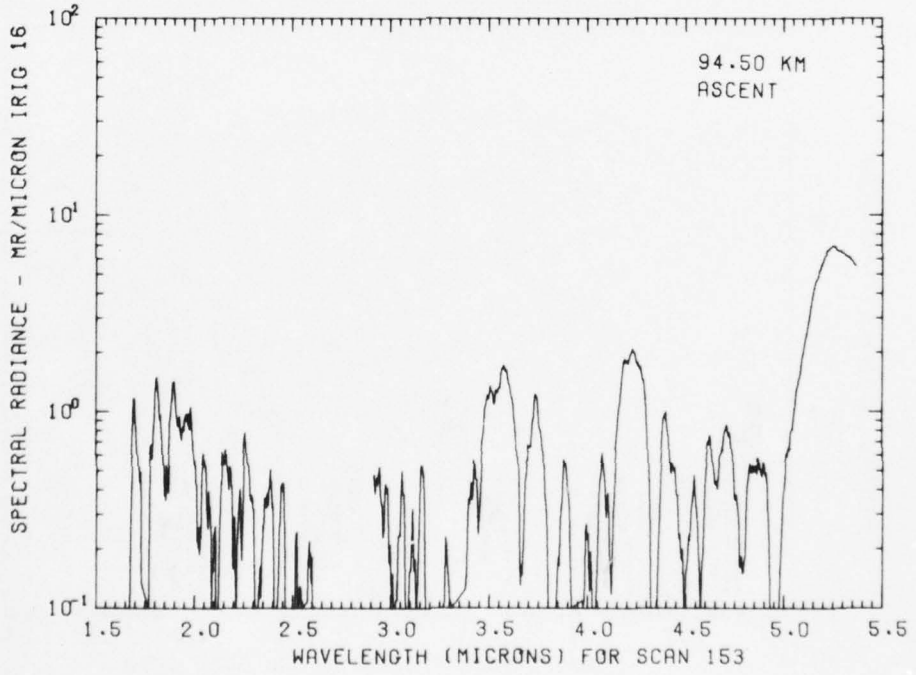

89.77 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 139

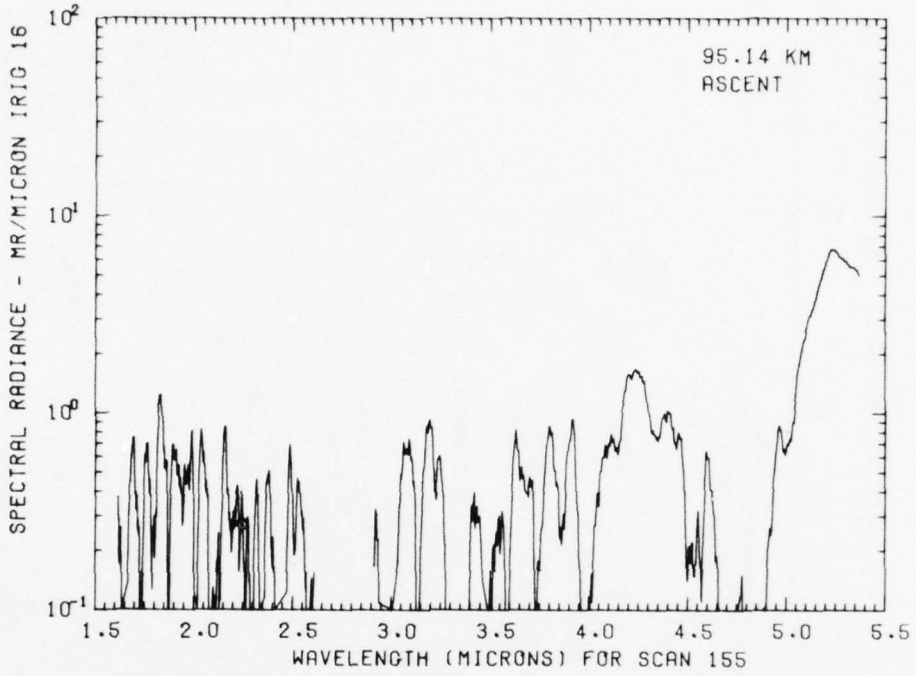

90.47 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 141

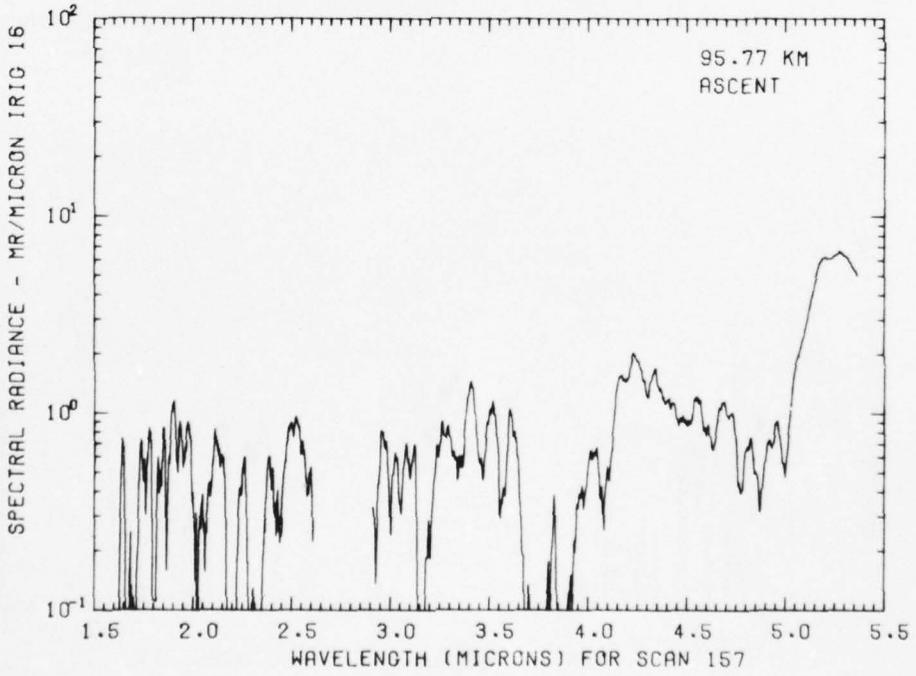

91.17 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 143

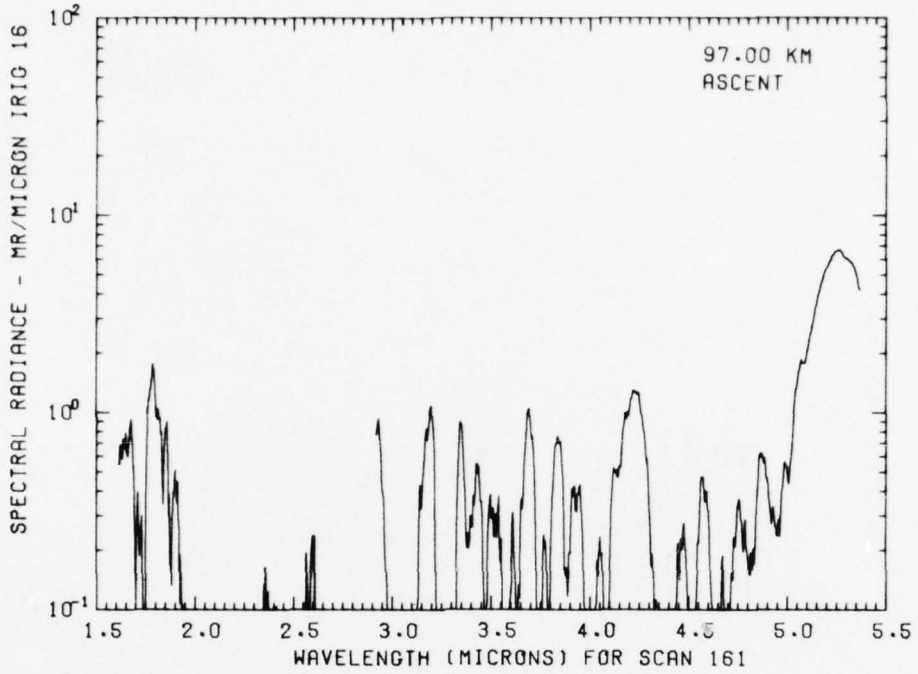

91.85 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 145

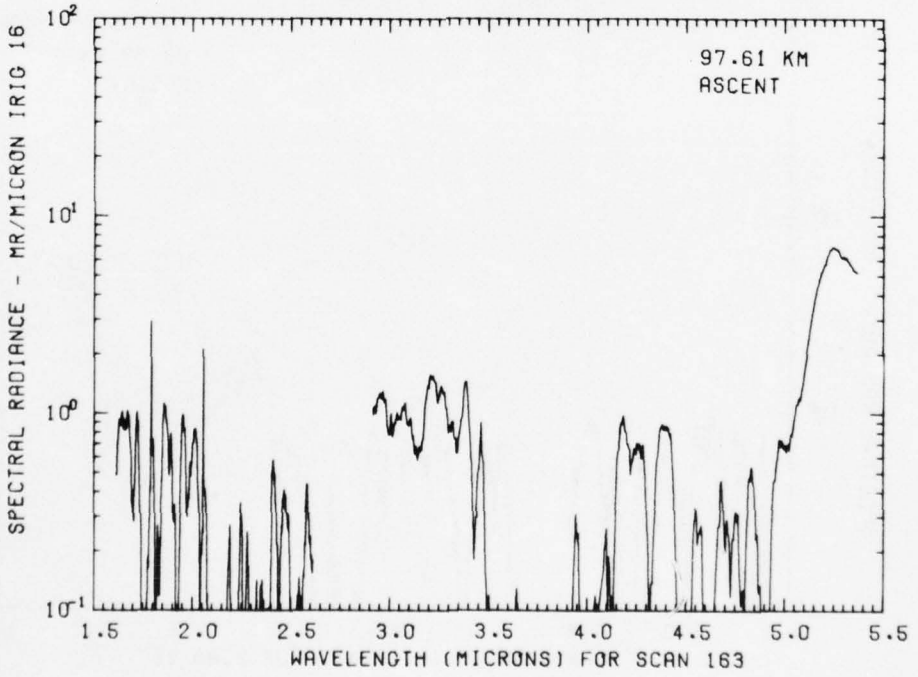

93.85 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 151

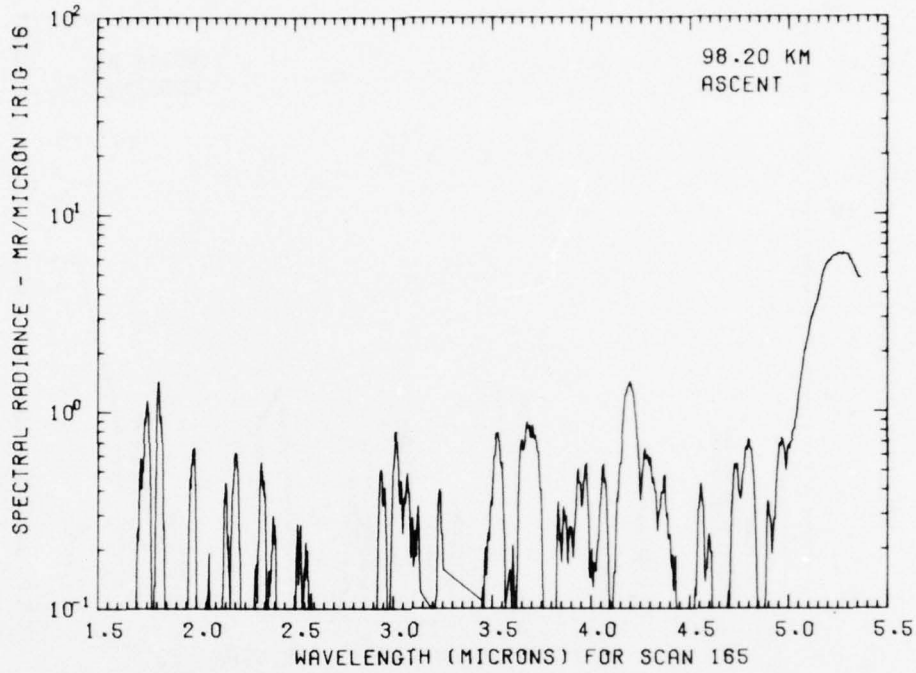

94.50 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 153

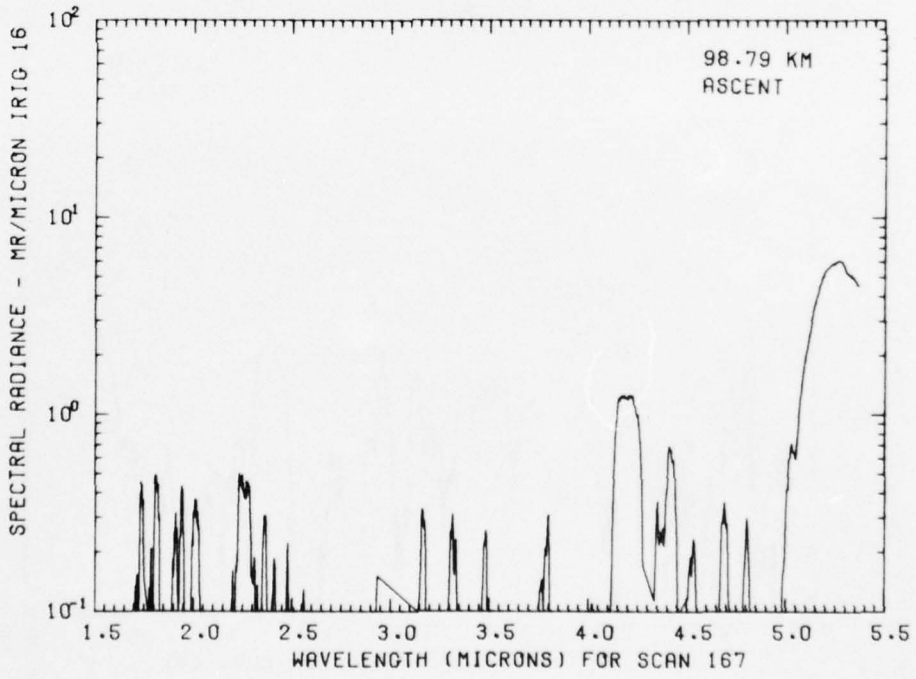

95.14 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 155

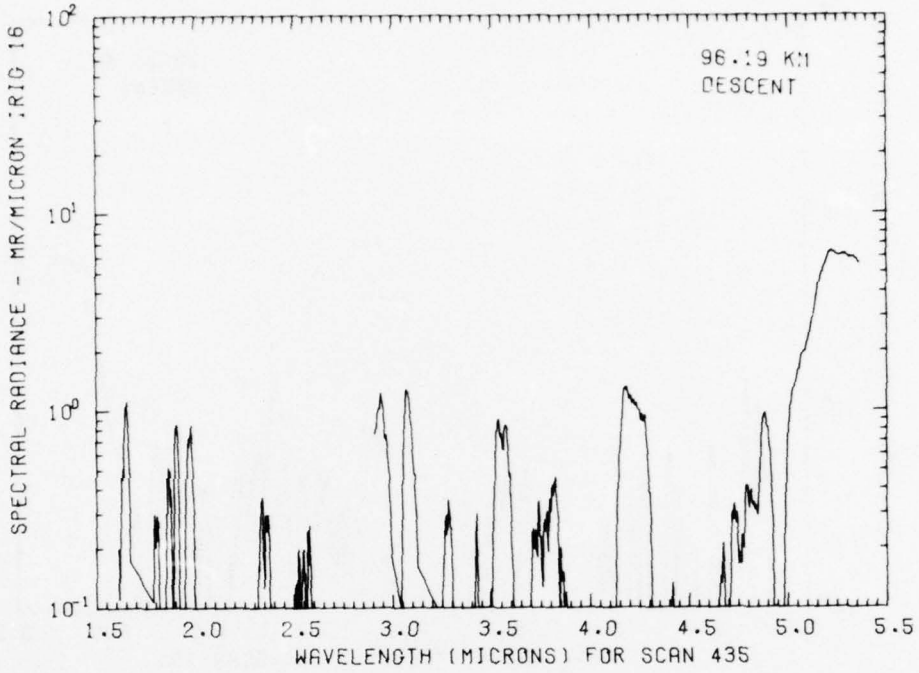

95.77 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 157

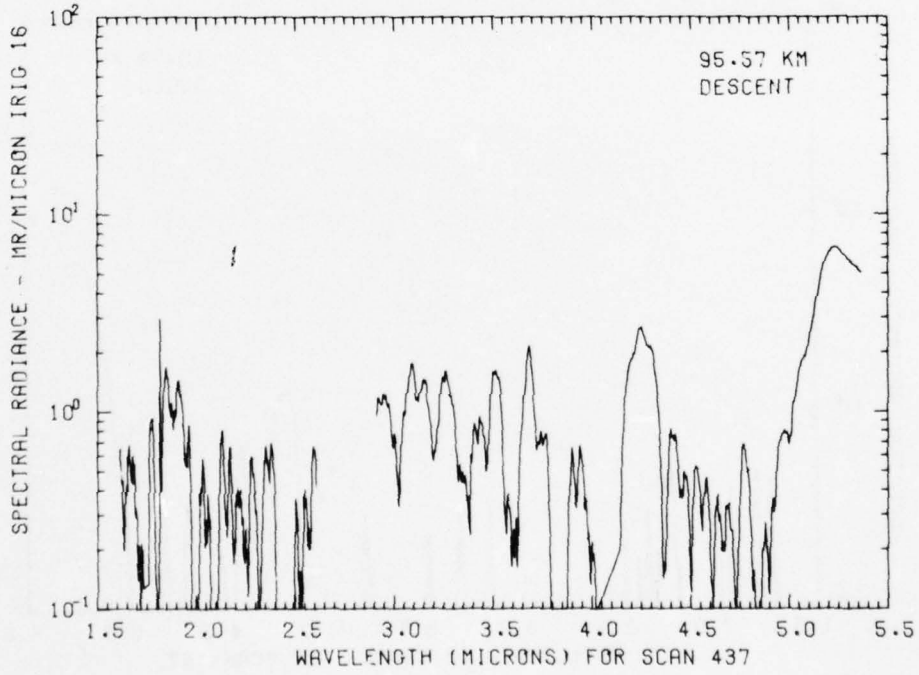

97.00 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 161

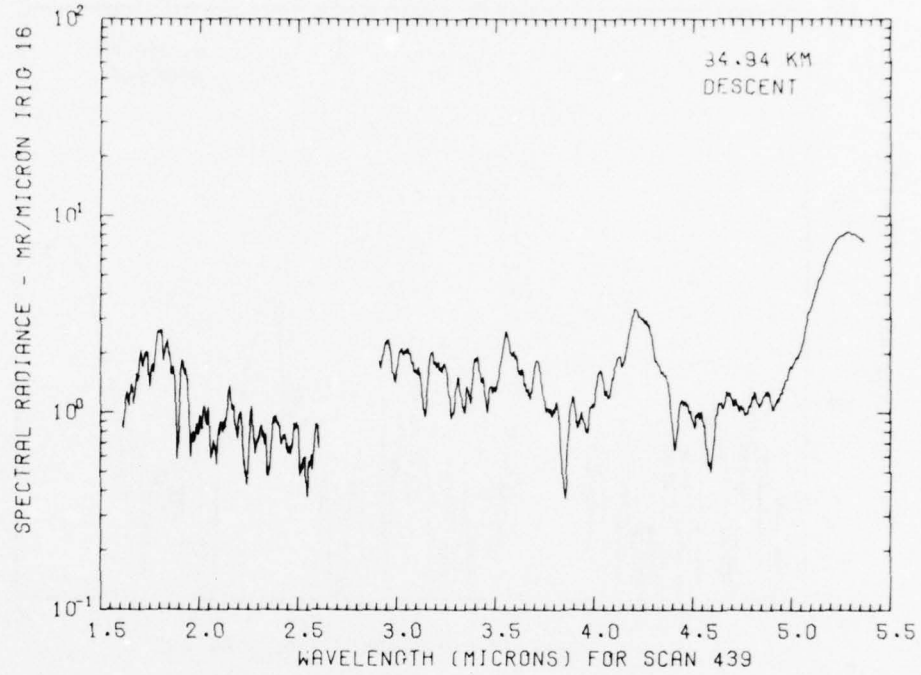

97.61 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 163

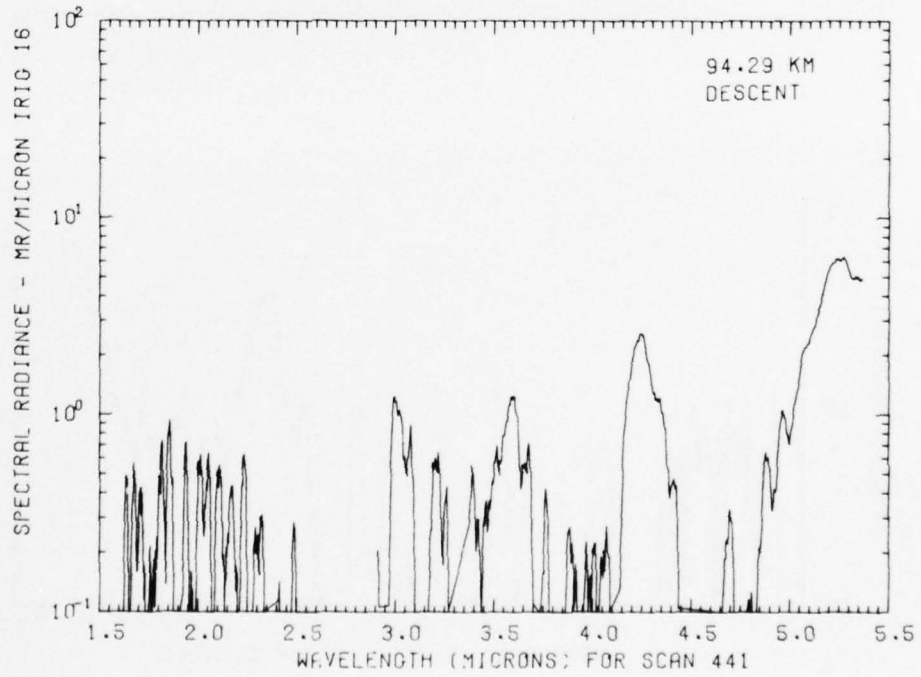

98.20 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 165

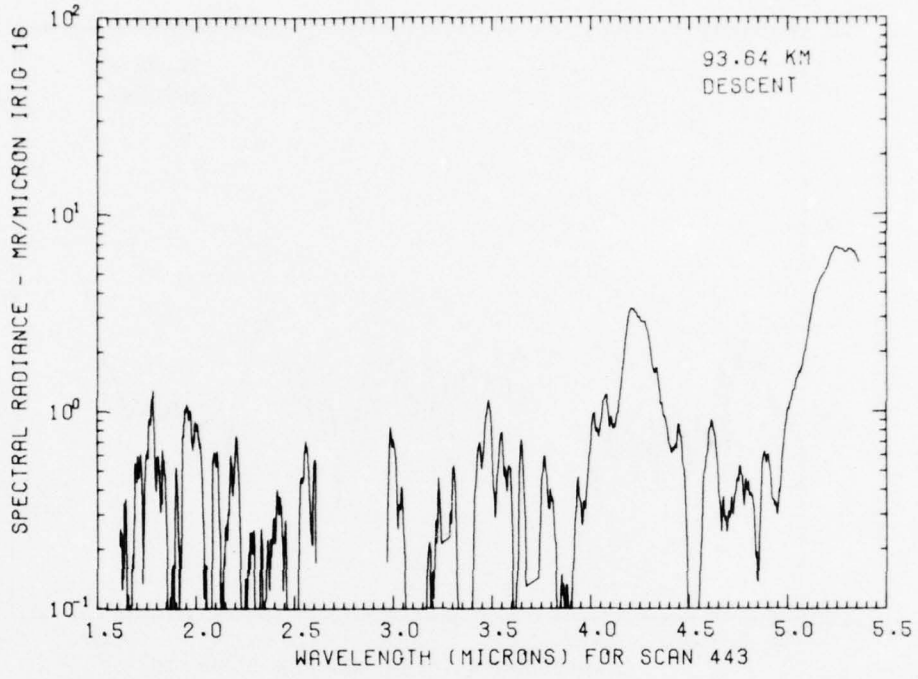

98.79 KM
ASCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 167

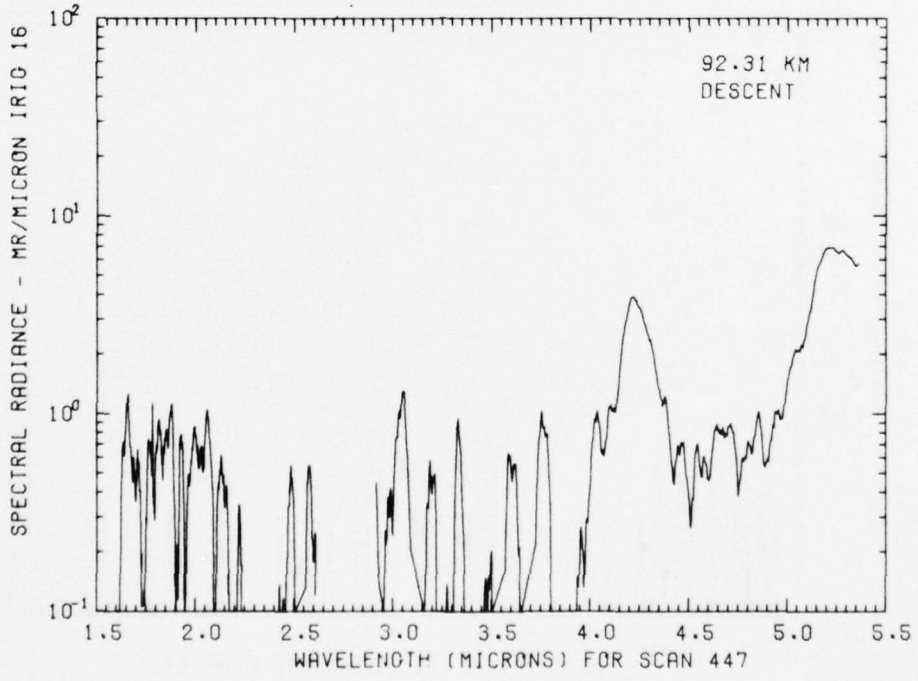

96.19 KM
DESCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 435

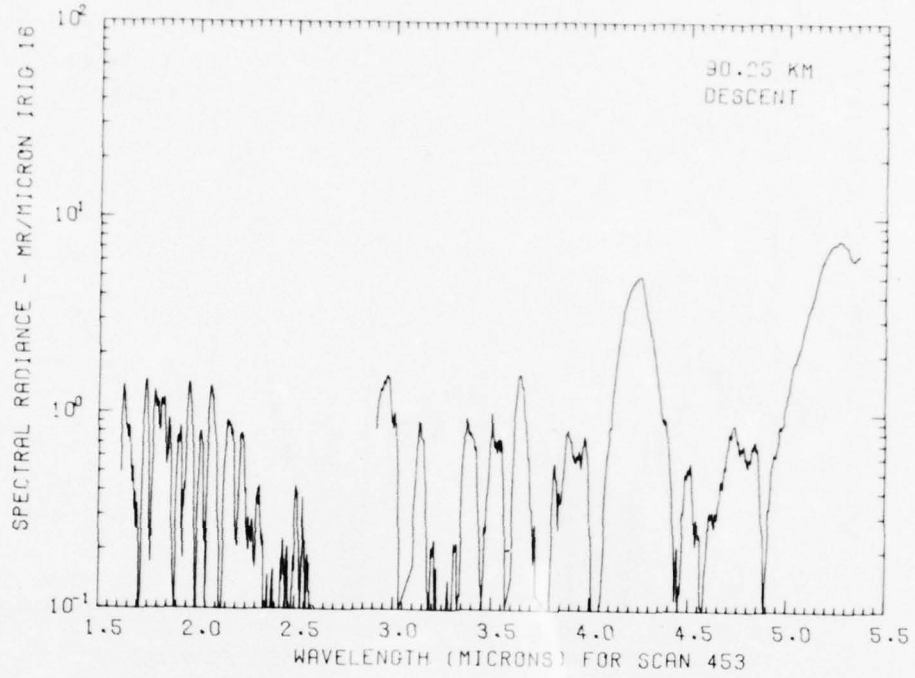

95.57 KM
DESCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 437

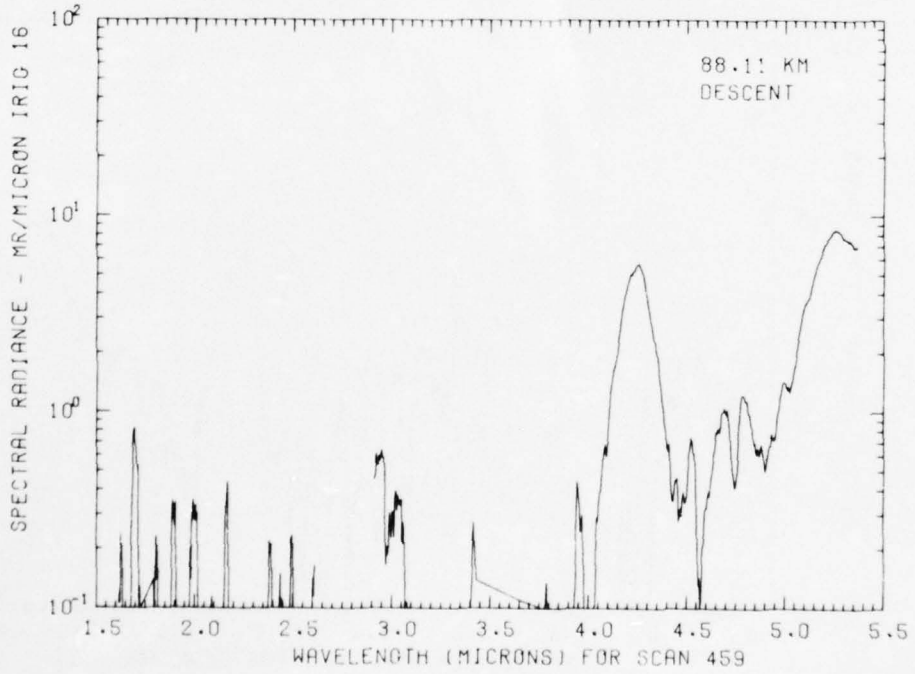

34.84 KM
DESCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 439

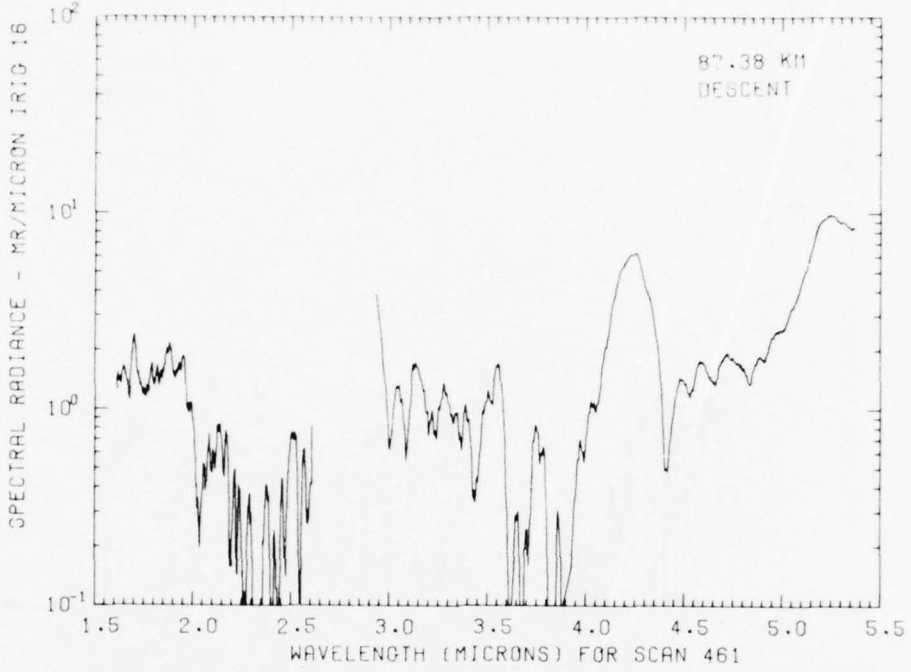

94.29 KM
DESCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
WAVELENGTH (MICRONS) FOR SCAN 441

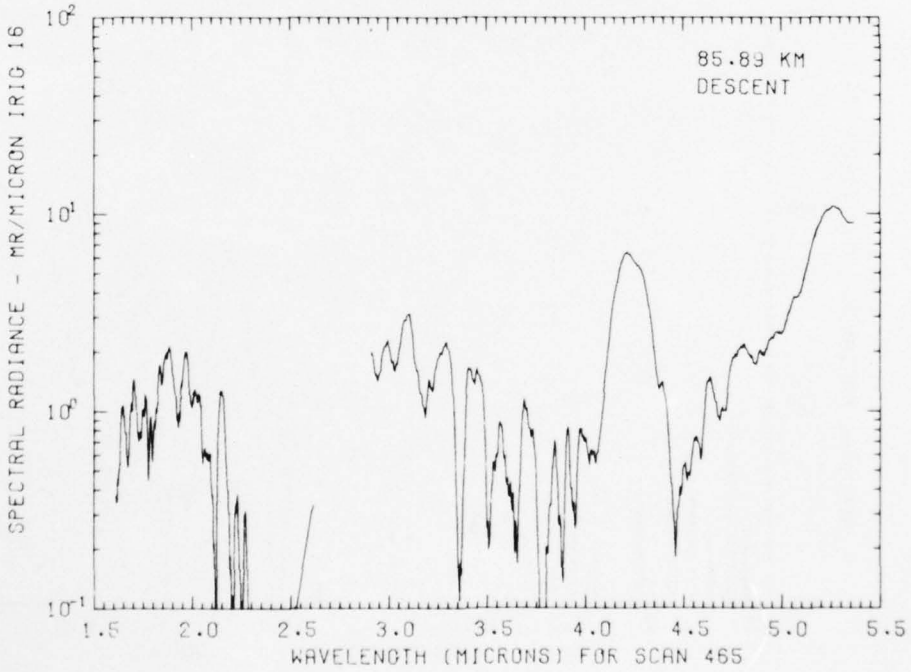

93.64 KM
DESCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 443


92.31 KM
DESCENT
SPECTRAL RADIANCE - MR/MICRON IRIG 16
10^2
10^1
10^0
10^{-1}
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
WAVELENGTH (MICRONS) FOR SCAN 447









Appendix D

NASA VERLORT Radar Beacon Track

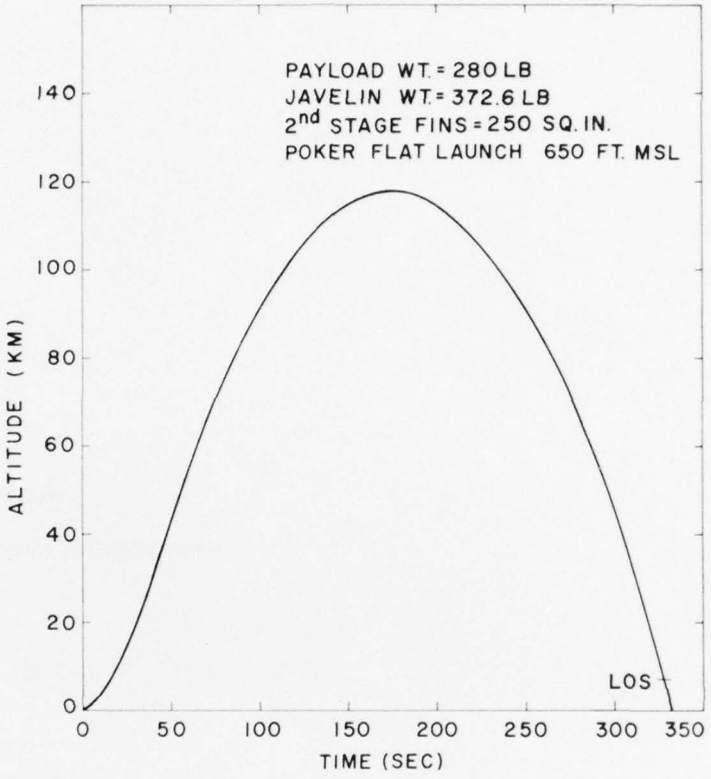


Figure D1. NIKE-JAVELIN NJ-74-1 NASA VELORT Radar Beacon Track

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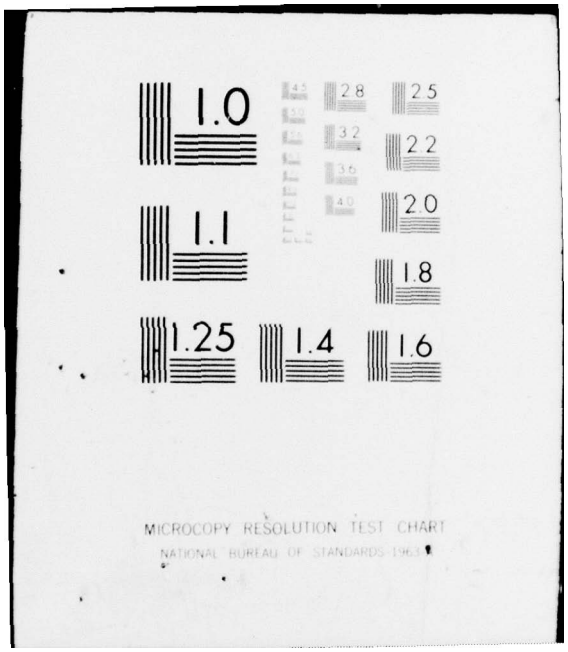
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